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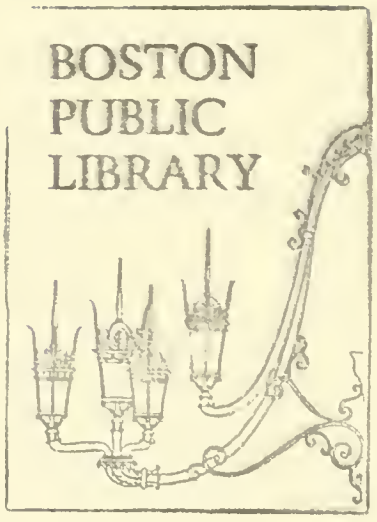
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CENTRAL ARTERY CORRIDOR

SOUTH AREA PLANNING STUDY

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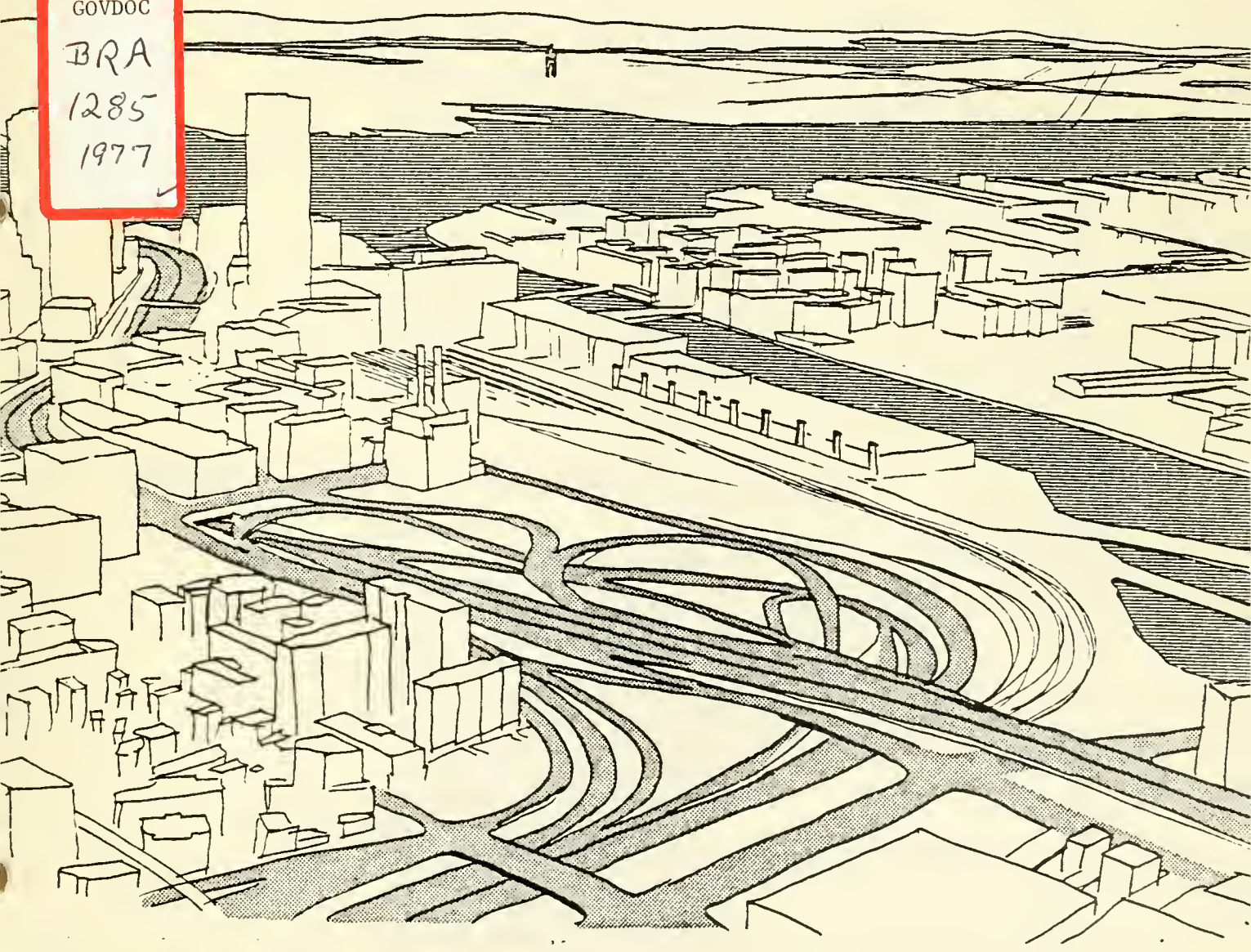

BOSTON, MASS. AUGUST 1977

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CHAPTER I: SUMMARY OF FINDINGS

I.A PURPOSE

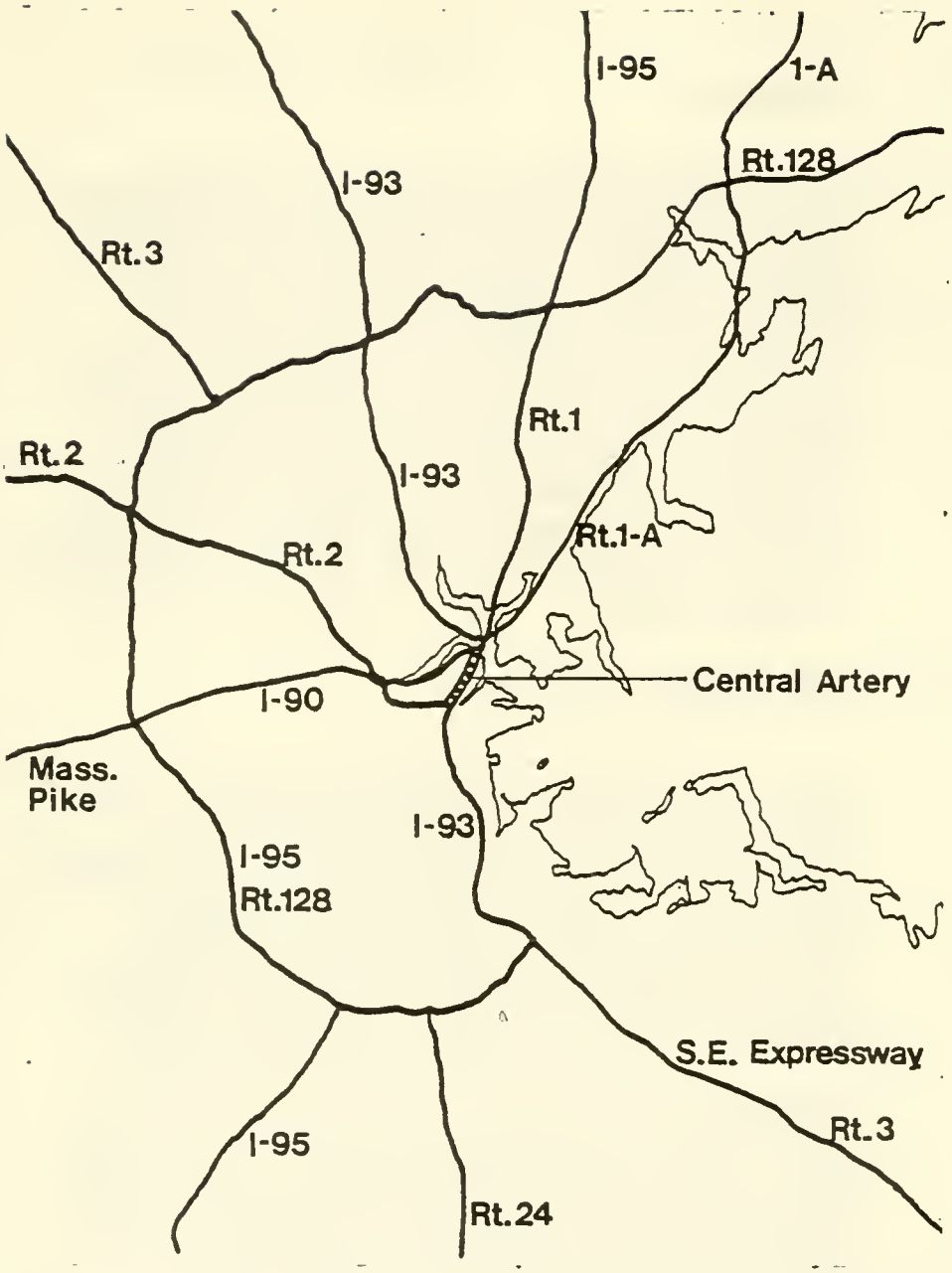
The purpose of this report is to document the preliminary engineering and environmental impact assessment done to date for the South Area of Boston's Central Artery and to support the need for detailed engineering and related studies. Analyses of the Artery from the period prior to its completion to the present are summarized and alternatives which remain viable are documented. Recent analysis by the Massachusetts Department of Public Works, which divides the Artery into North, Central and South Areas, forms the basis of the report.

I.B THE ARTERY CORRIDOR

The corridor of the Central Artery extends from I-93 and the Mystic Bridge in Charlestown on the north through Downtown Boston to the interchange of Massachusetts Avenue and the Southeast Expressway. Within this area, the Artery connects with the Sumner/Callahan Tunnels serving Logan Airport, Storrow Drive and major arterials feeding into Downtown Boston.

Included within the corridor are several important and distinct districts of the City: the financial district, the retail shopping area, the office district, the Government Center, the industrial and seaport areas in South Boston and Charlestown, the industrial areas of East Cambridge and Charlestown, the North End, the North Station area, the Waterfront, Chinatown, the South End, West End, South Cove and South Boston residential areas.

The present Central Artery Corridor extends approximately three miles into and through Downtown Boston. When the Artery was constructed in the 1950's it was conceived as a major link in a full expressway network. The Artery was viewed as the most important link and was built before the federal interstate highway program. Without federal assistance, the design was restricted. It includes six



REGIONAL NETWORK Figure 1

lanes and no breakdown lanes. The Artery has a total of 42 ramps, 25 for local service and 17 for connections to expressways, the Mystic Bridge and the tunnels. Ramp traffic, because of the original design, has insufficient sight lines and no acceleration and deceleration lanes. Many ramps are placed too close together, causing conflict with local vehicular and pedestrian traffic. There is a partial under-Artery road system, but because of the aerial configuration of the Artery,

this system has not produced many benefits for Downtown other than marginal access and parking.

I.C AREAS WITHIN THE ARTERY CORRIDOR

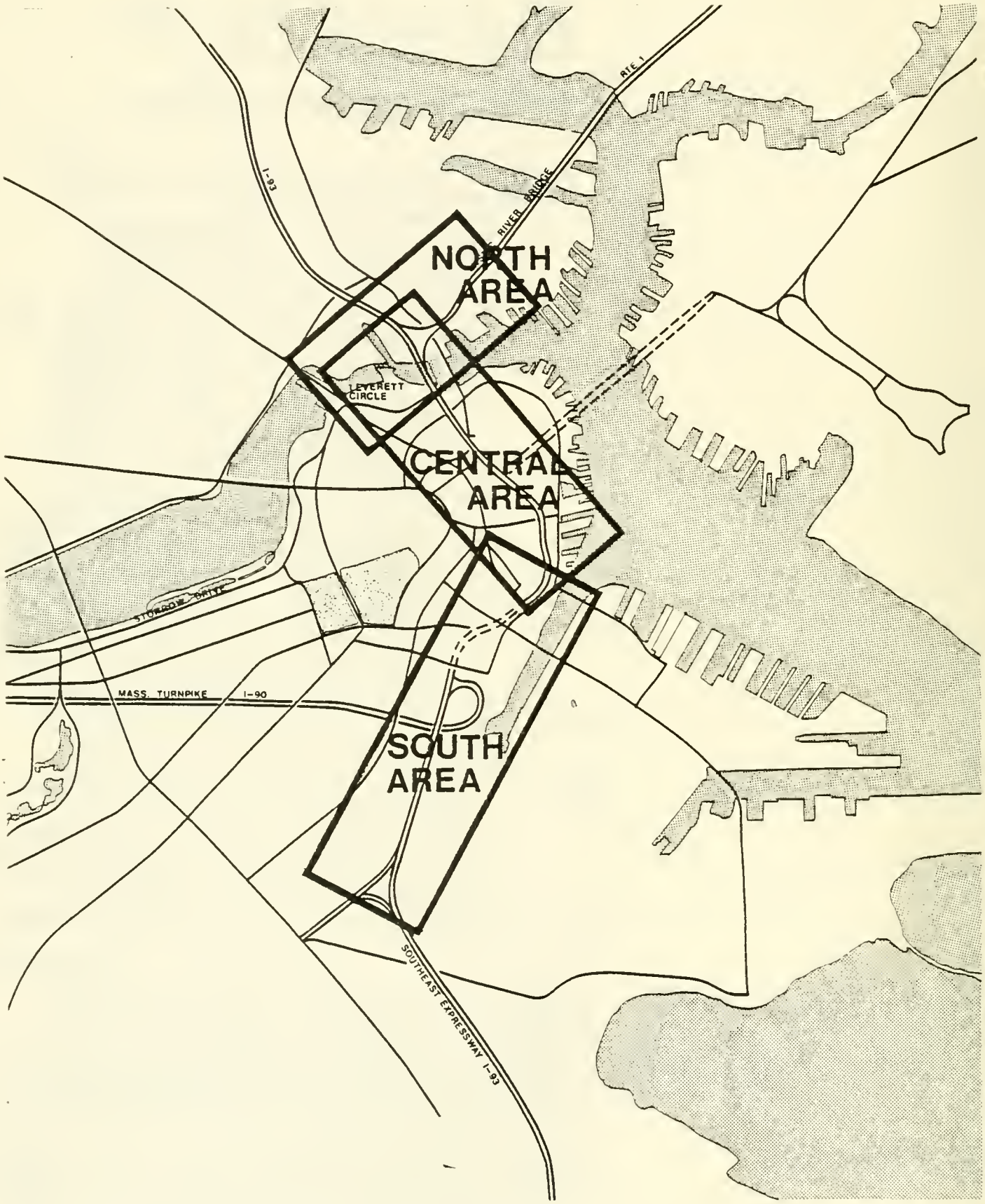
There are three distinct improvement areas within the corridor:

1. The North Area - as recently defined by the Massachusetts Department of Public Works, lies physically in Charlestown and north of the Charles River. Functionally, this area serves connections to the Mystic Bridge, and I-93 north. Connections to Storrow Drive and to the Sumner-Callahan Tunnels affect the North Area, though they lie on the Downtown side of the Charles River.
2. The Central Area - lies physically in the Downtown Boston peninsula and extends from the Charles River to the existing South Station tunnel of the Artery near Congress Street. Functionally this area relates to the North Area, providing connections to the harbor tunnels, Storrow Drive and the Downtown arterial streets.
3. The South Area - extends from the beginning of the South Station tunnel of the Artery at Northern Avenue to the Massachusetts Avenue interchange with the Southeast Expressway. It includes the interchange with the Massachusetts Turnpike, part of the Southeast Expressway and the ramps to the local streets serving South Station and the retail area.

This identification of areas by the DPW permits the advancement of projects in definable, manageable parts. It is now possible to examine, and construct, elements that function individually and mesh with longer-range options for other areas of the Corridor.

There are four principal advantages to looking at individual areas:

a. Greater focus of analysis on alternatives and their impacts;
b. Isolation of functional distinctions and highlighting of different ways



ARTERY CORRIDOR STUDY AREAS

Figure 2

the Artery performs, to serve aa host of distinct but related transportation problems;

c. Realistic assessment of the probable sequencing of construction timing and funding for implementation of potential project elements;

d. Provision for alternative improvements on a varying scale of expenditure, to maximize benefits and to direct project elements toward solutions of individual problems.

The balance of this report deals with the South Area of the Central Artery Corridor and offers substantial solutions to several problems associated with the Artery. Other potential projects - both highway and transit - for the Central and North areas would not be precluded by implementing South area improvements.

I.D THE SOUTH AREA

The South Area of the Central Artery Corridor lies on the south side of the Downtown Boston peninsula and includes the Dewey Square (or South Station) unnel and the elevated portion of the roadway leading into the Southeast Expressway. Throughout its length, the Artery in the South Area is designated Interstate Route I-93. The major intersection in the South Area is the complex interchange with the terminus of the Massachusetts Turnpike (Interstate Route I-90). In addition, there are many other access ramps to local streets and arterials throughout the length of this portion of the Artery. South of the Turnpike interchange, frontage roads provide access to and from the Artery as well as service to industrial areas. Areas over the Dewey Square Tunnel include a surface arterial, which becomes parallel one-way streets north of Dewey Square.

I.D.1 Problems - Transportation Service

1. The two major expressways - the Turnpike and the Southeast Expressway - join the Artery just south of the Dewey Square Tunnel. The tunnel is a major constraint on both facilities.

2. The Dewey Square Tunnel was designed for 77,000 ADT: it now accommodates approximately 135,000 ADT.
3. Because of the substandard alignment in the Tunnel, capacity is restricted; traffic operates under forced flow during peak hours and often during off peak hours.
4. The present facility includes sub-standard sight lines, curvatures and grades, and lacks acceleration/ deceleration and breakdown lanes; ramps are numerous and are poorly spaced, causing short weaving distances.
5. Queuing on the expressways causes disperson of expressway traffic onto local streets.
6. Capacity of the Southeast Expressway is scheduled to be increased through reconstruction within the next few years; no such improvements are scheduled for the Artery in this area.
7. The decks of the Artery viaducts south of the tunnel are experiencing rapid deterioration and may need replacement in the near future. Emergency maintenance contracts have already attempted to reduce the rate of deck deterioration.
8. The South Area of the Artery experienced 449 reported accidents in 1975.

I.D.2 Problems - Environmental Impacts

1. Severe negative environmental impacts result from the air, noise, dirt and visual pollution in the area south of the Dewey Square Tunnel.
2. The surface artery above the Dewey Square Tunnel has insufficient capacity to accommodate diverted traffic. Further improvements to the surface artery are constrained by inadequate land availability.
3. Access between the Artery and surface streets is inadequate to serve Downtown financial and commercial needs; access locations are poorly adapted to emerging land use patterns and proposed new development.

4. Extensive land damages occurred in the construction of the Dewey Square Tunnel; these should not be extended further, but rather should be minimized through innovations where possible.
5. Traffic transfer within the interchange between the Artery and the Turnpike has the effect of causing extensive negative impacts on the Chinatown residential community immediately adjacent to it.

I.E ALTERNATIVE TO THE PRESENT CENTRAL ARTERY CORRIDOR

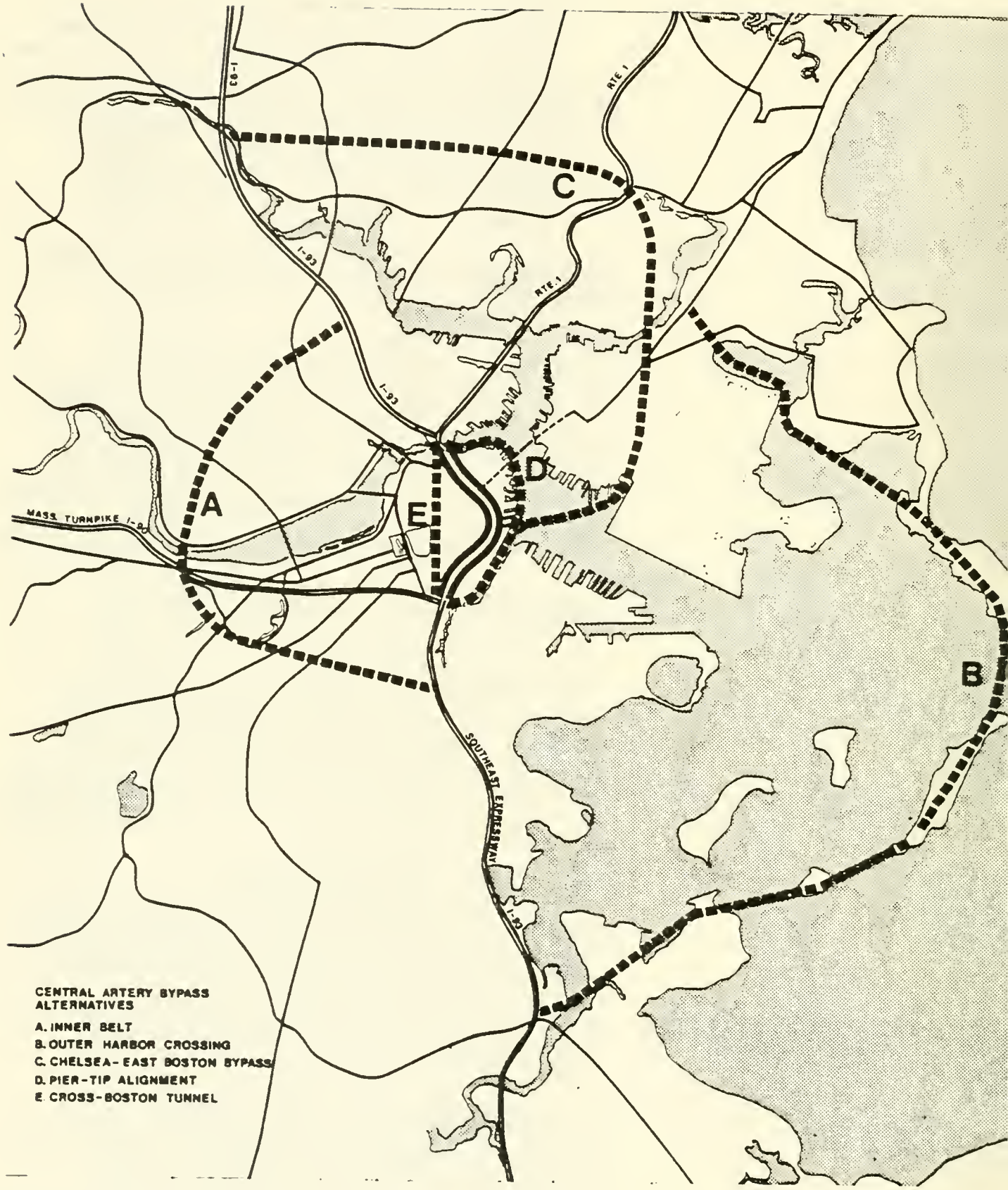
Several alternatives to the present Central Artery corridor have been explored in the past and in recent studies. These have been extensively re-examined and found wanting to solve the safety and operational problems of the Artery. The alternatives to the Corridor are described below, and illustrated in Figure 3; each has been dropped from further consideration.

I.E.1 Alignments Outside the Corridor

1. The Inner Belt
Ruled out by the Governor in 1971 for these reasons: residential takings and relocation requirements, community disruption, community protest, technical questions regarding ability to accommodate projected volumes; generation of additional traffic for core area.

2. Outer Harbor Crossings
(from Quincy to Winthrop via the harbor islands by a combination of bridges and surface facilities) ruled out because of: 4(f) impacts, intrusion into the flight paths of Logan Airport, inadequate provision for connections to other expressways, no downtown collection/ distribution relief.

3. Chelsea/East Boston Bypass
(from I-93 North via Chelsea and East Boston to tunnel under harbor) ruled out, among other reasons, because of: residential takings and relocation requirements, community disruption, impacts on shipping in Chelsea Creek, long tunnel under East Boston, dependence on I-95 in Lynn (dropped in 1972) and I-95 Relocation in Revere (dropped in 1972). The tunnel



ALTERNATIVES TO THE ARTERY CORRIDOR

Figure 3

under the harbor which is part of this alternative, has been retained and is the Third Harbor Crossing, a part of the projected ultimate Interstate network.

4. Pier Tip Bypass
(from Charlestown to South Boston via a harbor tunnel along the tips of the downtown piers) ruled out because of: lack of necessary connections with Sumner-Callahan Tunnels, steep grades, difficult design and engineering problems including ventilation and interconnections with other expressways.

5. Cross Boston Tunnel
(from Charlestown to South Station via a tunnel under Beacon Hill, the Common and the retail area) ruled out because of: technical feasibility, questions of grades, ventilation, interconnections with expressways, failure to connect (except by tunnel) to Sumner-Callahan Tunnels, no collection/distribution service to Downtown.

I.E.2 Conclusions of Problem and Corridor Analysis

A. Alternative alignments for all or part of the present functions of the Artery cannot be found outside the present corridor.

B. High costs are incurred in all alternative corridors.

C. The present corridor is the only one which can reasonably effectively connect with all existing expressways and serve Downtown collection and distribution needs.

D. The present Artery corridor must be retained in use in virtually all instances for collection/distribution functions and for connections to tunnels.

E. Deck improvements to the present elevated portions of the South Section of the Artery will be required in the immediate future if no other improvements are undertaken.

F. Specific alternatives for deck

improvements and other alternatives must be developed within the present Artery corridor.

G. Operational and safety problems associated with the present facility should be corrected in the development of alternatives for improvement.

I.F ALTERNATIVES WITHIN THE PRESENT CORRIDOR

.F.1 Alternative Reduction

The South Area of the Artery passes through highly valued land areas that forms a major constraint to the development of alternatives. Several alternatives which would improve the functioning of the Artery have been dropped because of extensive potential land damages. These include:

A. Double-decking of the present facility
This option has been dropped because of impacts on adjacent areas, including buildings that are proximate to the Artery, particularly in the congested areas around the Dewey Square Tunnel; difficult design and engineering problems of connecting the tunnel and upper roadway to other expressways and local streets without extensive land damages; additional lanes, which would be provided by the double-decking, may be unwarranted and in conflict with regional transit and air quality control plans; additional vertical construction would serve to further deteriorate the environment.

B. Widening the Dewey Square Tunnel
This option has been dropped as a viable solution because of impacts on adjacent areas and buildings, and the difficult design and engineering problems at ramp areas and for connections to the expressways. Partial widening has been discussed as a possibility for minimal improvements, but this option has also been dropped because of major land damages associated with widening the tunnel. South of the Dewey Square Tunnel widening has been retained as a possible improvement.

The potential projects which influence decisions in the South Area of the Artery Corridor are:

1. The proposed improvements in the Central Area of the Artery Corridor.
2. The proposed Third Harbor Tunnel between Downtown and Logan Airport. If constructed, this project would connect only to Logan Airport. It has two possible forms of service:
   a. A special purpose tunnel, serving only buses, trucks, taxis and emergency vehicles to and from the Airport.
   b. A general purpose tunnel serving all types of vehicles to and from the Airport.
3. The proposed rail connection between North Station and South Station. This proposal is applicable only to the alternatives for the Central Area of the Artery Corridor.

I.F.2 Alternatives for Examination

The alternatives which result from combining the options for the South Area of the Artery Corridor are illustrated in the following figure.

Figure 4: SOUTH AREA ALTERNATIVES

	Without 3rd H.C.	With 3rd Harbor Crossing	
		Special Purpose	General Purpose
NO BUILD	Alt. 1	Alt. 2	Alt. 3
RECONSTRUCTION WITHOUT AREA	Alt. 4	Alt. 5	Alt. 6
RECONSTRUCTION WITH CENTRAL CENTRAL AREA	Alt. 7	Alt. 8	Alt. 9

Alternative 1 - The No Build Alternative

The No Build Alternative has been developed to explore the possibility of retaining the existing facility, with some modifications to it in order to prolong the useful life. The Artery in the South Area will need replacement of the decks within the near future if no other improvements are made. Following is one method for undertaking this work:

> Rebuilding of one lane of the decks at a time. This method is a standard technique when traffic must be maintained. It has the obvious disadvantage of reducing capacity on a roadway and in this case reducing it by at least one-third. However, during the maintenance operations previously mentioned, some capacity was available on the parallel frontage roads along both sides of the viaduct, i.e., Albany Street on the western side and Frontage Road on the eastern side. If full reconstruction of the viaduct were undertaken, these parallel roadways could be used during the construction period to act as a queue bypass.

Alternative 1 can be constructed with or without the proposed Central Area project in the Artery Corridor.

Alternative 2 - The No Build Alternative with a Special Purpose Third Harbor Tunnel

Alternative 2 is similar to Alternative 1 in all respects, except for a Special Purpose Third Harbor Tunnel. The connection between the South Area expressway facilities and the proposed tunnel would be made at the interchange between the Southeast Expressway and the Turnpike. The two-way Special Purpose Tunnel would be located in the Fort Point Channel. Dewey Square Tunnel would remain unchanged.

This alternative has no Artery improvements and would have serious disadvantages for the overall improvement of the Artery and upgrading its safety and efficiency. It would foreclose any major future improvements to the South Area of the Artery and continue the existing substandard operational and safety conditions in the Dewey Square Tunnel.

While it would provide improved service to limited types of vehicles, it would primarily serve only those vehicles approaching it from the West and South. From other directions such vehicles would have to travel the full length of the Artery to reach the Tunnel approaches. It would have the salutory effect of removing vehicles from the Central Area of the Corridor, to the extent that the service provided by buses or other multiple occupancy vehicles could attract more ridership.

Alternative 3 - The No Build Alternative with a General Purpose Third Harbor Tunnel

This alternative is identical to Alternative 2 with the added feature of diverting traffic from the existing Artery. As in Alternative 2, the proposed harbor tunnel would be built in the Fort Point Channel with its interchange at the junction of the Southeast Expressway and the Massachusetts Pike. There would be no changes in the existing Dewey Square Tunnel.

Alternative 4 - Reconstruction of the South Area of the Artery without the Central Area Project

In this alternative, the South Area of the Artery is reconstructed but no major improvements are made to the Central Section. The reconstruction of the South Area would include the Fort Point Channel northbound tunnel that would be connected to the elevated Central section in the vicinity of Northern Avenue. The Dewey Square Tunnel would be retained for southbound movement. Modification

of the tunnel and ramps near South Station would be necessary as well as new ramps to service the South Station Transportation Terminal. Local street connections would be modified to provide improved service between the expressways and the surface street network.

Additional capacity in the Dewey Square Tunnel would provide traffic relief for the South Area. New connections to the local street network would improve access to and from the South Boston Seaport areas, South Station and the proposed transportation terminal, and the retail and financial districts of Downtown Boston. Since these improvements connect directly with the Central Area of the Artery, the Massachusetts Turnpike, and the Southeast Expressway, each of the facilities would also benefit from improved traffic service in the South Area.

Alternative 5 - Reconstruction of the South Area of the Artery without the Central Area Project and with a Special Purpose Third Harbor Tunnel

This alternative is similar to Alternative 4, with the addition of the special purpose tunnel to and from the Airport. Connection to and from the harbor tunnel would be made via the relocated northbound roadway in the Fort Point Channel.

This alternative would allow construction of the northbound roadway and the special purpose tunnel to be undertaken without disruption to existing traffic.

Alternative 6 - Reconstruction of the South Area of the Artery without the Central Area Project and with a General Purpose Third Harbor Tunnel

This alternative is essentially identical to Alternative 5 with the exception of general purpose traffic utilizing the proposed harbor tunnel.

Alternative 7 - Reconstruction of the South Area of the Artery with the Central Area Project

Alternative 7 provides for a major improvement in the South Area with the construction of a new north bound roadway in the Fort Point Channel. The existing Dewey Square Tunnel would then become one-way south bound. Both the relocated north bound roadway and the improved south bound roadway would be linked to a reconstructed Central Area. This connection, located near the Northern Avenue Bridge, would be underground. Revisions to the existing ramps in the Dewey Square Tunnel would be necessary to provide appropriate connections with local streets. New connections to local streets would be provided from the new northbound tunnel to local streets including Northern Avenue, Kneeland Street/Atlantic Avenue, Broadway as well as access to and from the proposed transportation terminal at South Station. Additional connections could be provided at a later date to the proposed Third Harbor Tunnel if that facility is to be constructed.

In this alternative, construction of the northbound roadway in the Fort Point Channel would be undertaken without serious disruption to existing traffic. After completion of the tunnel, connections to roadways on either end of the Dewey Square Tunnel can be reconstructed without excessive traffic disruption. As northbound traffic would be in the new alignment, southbound traffic can be detoured between the existing north and south bound lanes of the Dewey Square Tunnel during construction.

The proposed North Station - South Station rail connection, which is part of the Central Area project, is not a part of any alternative for the South Area, except immediately behind South Station. At that location, direct access roads from the South Area into the proposed South Station Transportation Terminal would have to cross the proposed alignment of the underground rail connection.

Alternative 8 - Reconstruction of the South Area of the Artery with the Central Area Project and a Special Purpose Third Harbor Tunnel

Alternative 8 is similar to Alternative 7 and includes a Special Purpose Third Harbor Tunnel to and from the Airport. The tunnel would connect with the South Area project at the mouth of the Fort Point Channel, and would link to the new northbound roadway and the existing Dewey Square Tunnel. Local street connections would be provided as in Alternative 7.

As in Alternative 7, construction of the northbound roadway and the special purpose tunnel would be undertaken without serious disruption to traffic on the I-93 northbound roadway. Construction phasing of this alternative would be interfaced with the Central Area phasing.

Alternative 9 - Reconstruction of the South Area of the Artery with the Central Area Project and a General Purpose Third Harbor Tunnel

Alternative 9 is identical to Alternative 8 except that the Third Harbor Tunnel is a general purpose facility to and from the Airport. The tunnel would connect with the South Project at the mouth of the Fort Point Channel and lead to the Airport access road. Direct connections to and from the North Shore would not be provided in this option. However, there would be direct connections for traffic from the Southeast Expressway and the Massachusetts Turnpike into the Harbor Tunnel. Access from the north and northwest to the Harbor Tunnel would be less direct; this traffic would continue to use the present harbor tunnels for access to and from the airport.

I.G CONCLUSIONS AND RECOMMENDATIONS

A. Improvement of portions of the South Area of the Artery Corridor will be required to be undertaken within the next ten years, if no other reconstruction is undertaken. The principal work is located south of the Dewey Square Tunnel on the decks of the elevated portion of the Artery between the Massachusetts Avenue Interchange and the Turnpike interchange.

B. There are no feasible alternatives to the present corridor of the Artery in the South Area.

C. A series of alternatives within the present corridor have been examined. Alternatives that improve service and safety without extensive negative environmental impacts are limited.

D. The corridor alternatives that should be studied in detail include Alternatives 1,4,5,6,7,8, and 9.

E. Alternatives that should not receive further examination are Alternatives 2 and 3. Each share the common problems of requiring major construction which does not address the present problems of the South Area of the Artery Corridor.

F. The Third Harbor Tunnel serves purposes and has benefits that are different from reconstruction of the Central Artery. All South Area alternatives - other than the no-build (Alternative 1) - should be designed to accommodate the Harbor Tunnel as a future project, and it should be retained as a part of the long-range plan. It is feasible to proceed with the reconstruction of the South Area of the Artery Corridor in advance of the Central Area project. Detailed study of design, costs and impacts of the Third Harbor Tunnel should proceed separately from the Artery project. Future network analyses of the Artery project should

include both build and no-build options of the Third Harbor Tunnel.

G. Detailed analysis of each of the alternatives is necessary; in particular the following tasks should receive special attention.

a. All alternatives require detailed analysis of:

- construction techniques and phasing
- traffic maintenance during construction
- transportation service
- demand/capacity analyses
- surface street impacts
- relation to harbor crossing demand and airport service
- safety during and after construction
- air, noise and water quality impacts
- economic impacts (regional and local) during and after construction
- social impacts to adjacent neighborhoods and the region, during and after construction
- land use and urban design considerations
- detailed cost estimates
- employment generation

b. Reconstruction alternatives require, in addition, detailed analyses of:

- ventilation requirements
- joint development opportunities
- decking requirements
- tunnelling requirements
- dangerous cargo handling
- joint rail line construction
- rail line service space requirements

CHAPTER II: THE SOUTH AREA

II.A DESCRIPTION OF THE EXISTING FACILITIES

The South Area is the key highway segment linking the Southeast Expressway (the only major highway from the South Shore Corridor) and Massachusetts Turnpike from the Western Corridor to downtown Boston and Logan Airport. Conflicts and congestion caused by the mix of local downtown traffic, Logan Airport traffic and intra-metropolitan through traffic reduce the level of service. In addition, the number of on-and-off ramps for local access in the relatively short distance provides poor highway geometrics with extremely short merging and weaving distances, causing traffic bottlenecks and unusually high incidence of accidents. Reduced sight distances within the Dewey Square Tunnel increase hazards on this section.

The South Area includes major gateways to Boston from the south and west. All vehicular and transit access from the south passes through the area; vehicular access from the west via the Massachusetts Turnpike also enters Downtown through this area. The geographic constraints on the area were formed by the rivers and harbor which still define the setting and affect land development and transportation.

Transportation linkages were established early in the corridor to the south. When first constructed in the early 19th century, they were built over bodies of water in order to connect to the downtown Boston peninsula. Bridges and roads built in the early 18th century provided the first links to the south corridor and gradually became major highways. Until construction of the Southeast Expressway (now I-93), major highways connecting the Boston Downtown to the South Corridor were Washington Street, Blue Hill Avenue, Dorchester Avenue, Summer Street and Broadway.

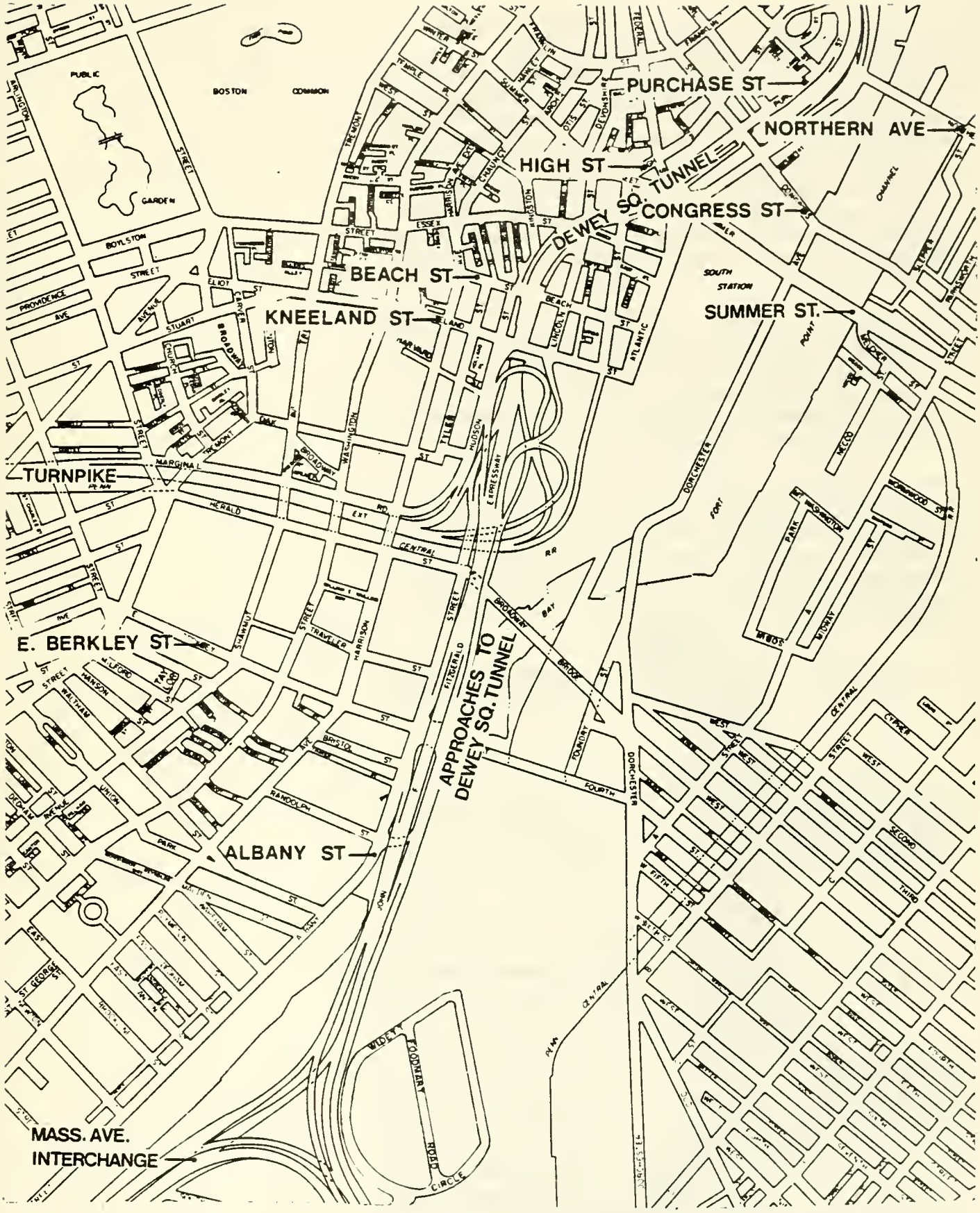
Rail lines to the south corridor originally served individual termini, but were consolidated into South Station in 1898. Certain of the lines to the west were also consolidated into South Station at that time. Upon completion of the Southeast Expressway the rail lines to the south corridor were abandoned for passenger service. Although the Red Line rapid transit serves the inner portions of the corridor, rail transit access to the south corridor was not provided until the opening of the Quincy Extension in 1973.

The major highway to the south - the Southeast Expressway - was built as an extension of the elevated portion of the Central Artery and opened in 1959. The Dewey Square Tunnel was a major portion of the construction necessary to link the Central Artery with the Expressway. Some years later, in 1965, the Massachusetts Turnpike from the west was added, with a terminus at the Central Artery in the vicinity of South Station. At the present time these two roadways form the major feeders into Downtown in the South Area. Both routes provide local service into neighborhoods along the fringe of Downtown.

II.B. SOUTH AREA SYSTEM CHARACTERISTICS

II.B.1. The Dewey Square Tunnel

From a traffic operations point-of-view, the South Area has a major inherent defect: all downtown-oriented traffic to and from the South must use the Dewey Square tunnel, its approaches from the South, or both. For traffic to and from the south, avoiding these two facilities is almost impossible. The only options are Dorchester Avenue-Broadway, Summer Street, or Massachusetts Avenue. Traffic to and from the west has similar but not so serious traffic operations problems. Such traffic can use Massachusetts Avenue to avoid the Artery Corridor, but all local street bypass routes eventually connect with the expressway network in the South Area.



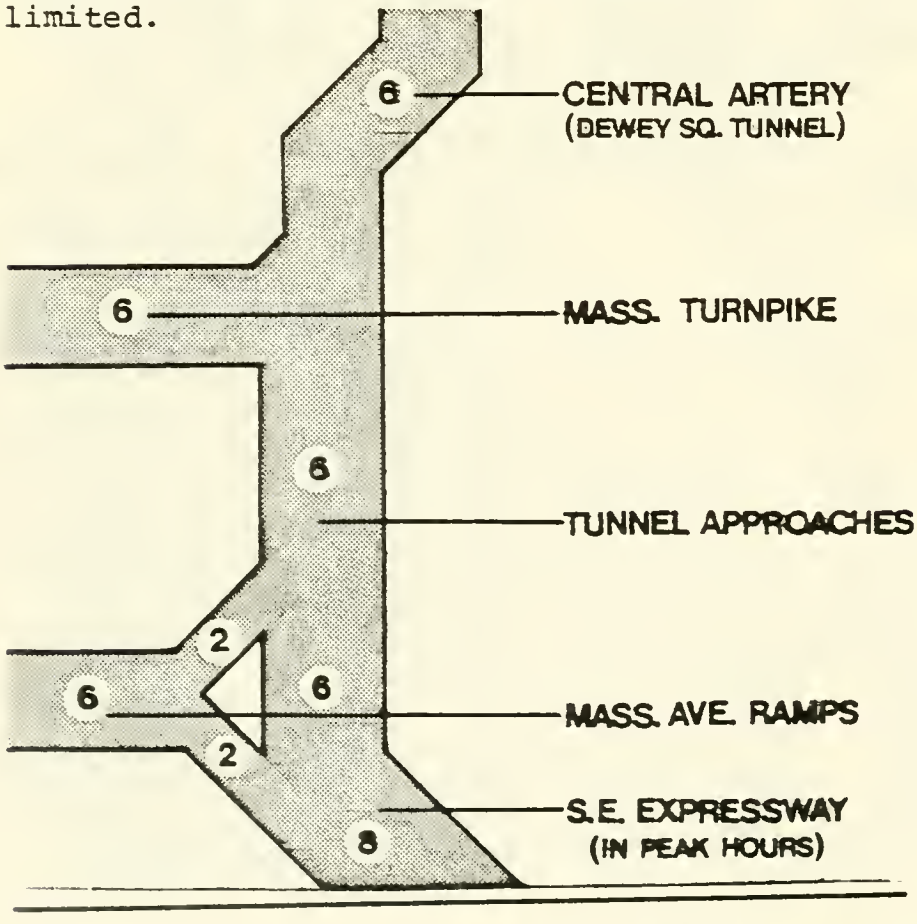
SOUTH AREA STREET SYSTEM

Figure 5

The cumulative effect of these problems produce a major impact on safety, operations and transportation service in the South Area. The major problem is the funnelling of traffic from expressways and arterial streets between the Massachusetts Avenue Interchange and the Massachusetts Turnpike into the 6 lane Dewey Square Tunnel. This section of the south area is inadequate to accommodate the heavy volume of traffic at acceptable operating levels.

For example, during the A.M. peak, traffic is allowed to use the shoulder of the Southeast Expressway. Figure 6 presents the lane configuration during the A.M. peak for inbound traffic. The reverse situation occurs during the evening peak.

The entire problem of lane imbalance on the Artery is magnified because of right-of-way limitations within the immediate Corridor, and the setting in a highly developed urban area where transportation impacts are severe and alternatives are limited.



SOUTH AREA EXPRESSWAY LANES

Figure 6

II.B.1.a. Highway and Tunnel Problems

The South Section of the Central Artery is a six lane facility extending from the Massachusetts Avenue Interchange to approximately the Northern Avenue on-ramp. The Section is split approximately in half with 50% being within a tunnel and the balance on viaduct. Typically, each roadway is 40 feet in width, having three 12-foot lanes with 2-foot lateral clearances on each side. There are neither shoulders nor breakdown bays on either the viaduct or within the tunnel. Auxiliary speed change lanes do exist between some entrance and exit ramps.

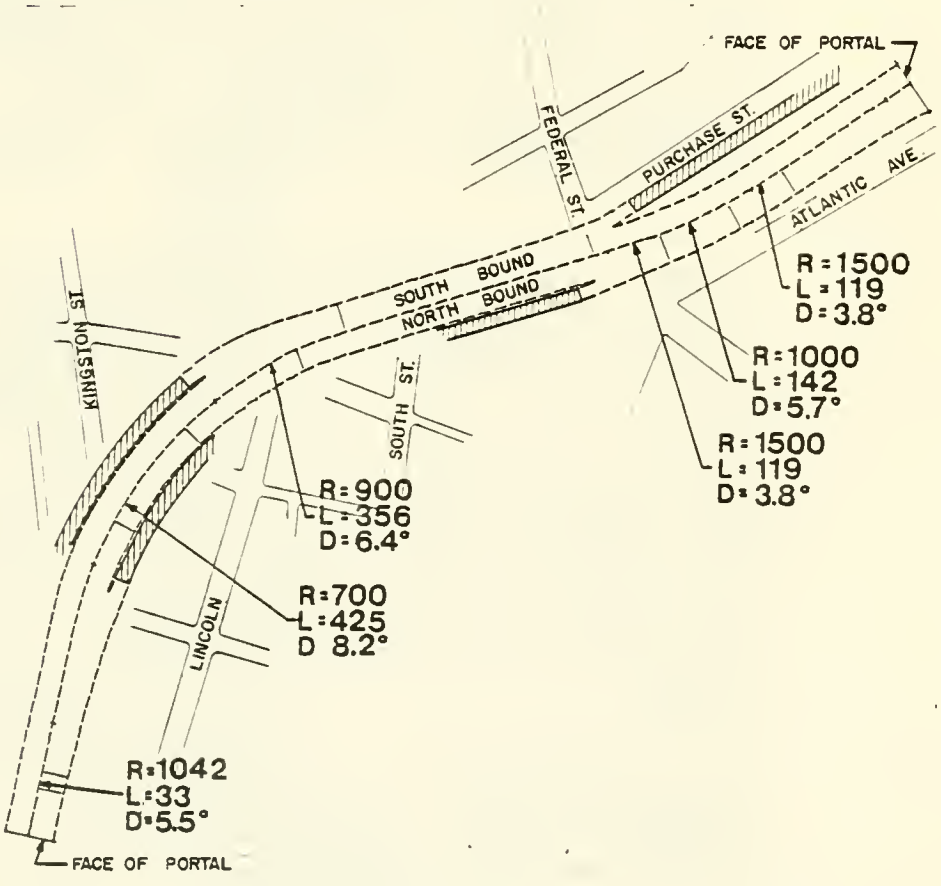
The 2500' 6 lane Dewey Square Tunnel is the only expressway link in the South Area between the highways to the south and the Central Artery giving access to Downtown and the north. It is the only portion of the Artery corridor that is currently in tunnel. The Dewey Square Tunnel poses the major constraints on the South Area in terms of its alignment, safety and capacity.

Between the Massachusetts Avenue interchange and the North portal of the tunnel there are seven ramps on the north bound roadway and eight on the southbound roadway. Ramp spacing varies between 700±' and 2500±' on the northbound roadway, and 770±' and 1450±' on the southbound roadway. Weaving maneuvers are generally one-sided weaves. Because of hazardous operational experiences in the past, one "off" ramp on the northbound tube has been permanently closed. In addition, during the morning peak, the Broadway "on" ramp south of the tunnel is closed.

Ramp spacing does not meet minimum design criteria. This item is particularly critical to operations on the facility. During peak hours this results in vehicles directly entering the main stream of traffic without the value of acceleration lanes or, when a speed change lane does exist between ramps, it is of insufficient length.

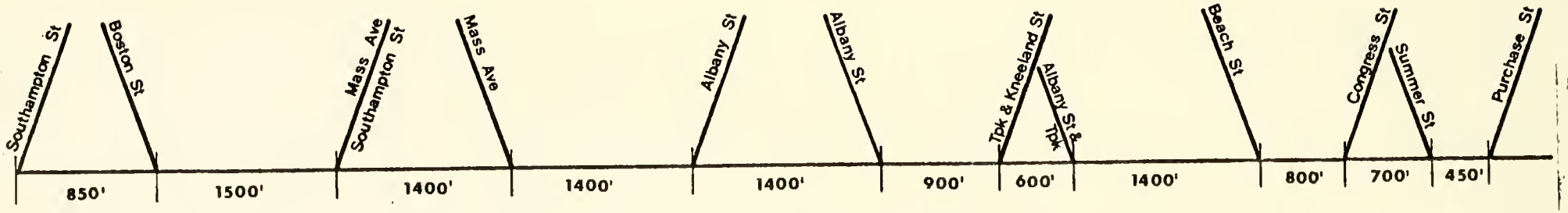
Critical geometrics within the south area are located within the tunnel. In general, both design and average highway speed on the Central Artery is 50 MPH. However, within the tunnel, design speed varies between 40 MPH and 50 MPH. Superelevation on curves within the tunnel varies between 0.01 and 0.015 feet per foot.

Not only are traffic operations affected by the variance in design speed in the tunnel, but also safety. The 40 MPH design section is part of a compounded curve. The balance of this curve has 50 MPH design speeds. Therefore, sight distance along the high speed lane of the south bound roadway changes along the curve from 350+' to 275+'. While not critical in peak hours this does introduce a deficiency in safety for those off peak hours when speeds approach 45-50 MPH. A similar situation exists in the outside lane of the northbound roadway throughout this compound curve section.

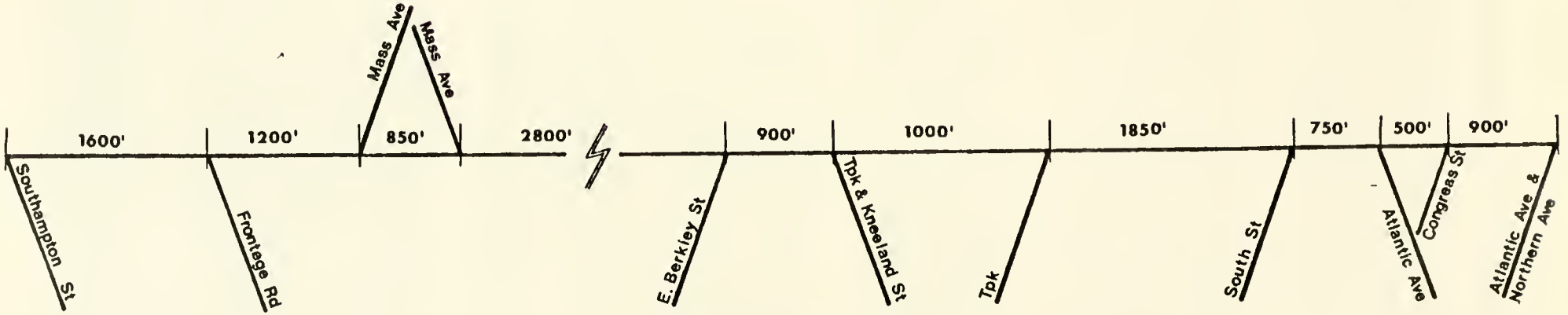


DEWEY SQUARE TUNNEL ALIGNMENT

Figure 7



SOUTHBOUND LANES



NORTHBOUND LANES

RAMP SPACING DIAGRAM

Figure 8

II.B.1.b Tunnel Connections to Surface Streets

The original plan for the Dewey Square Tunnel relied on connections with downtown arterials to provide maximum distribution and collection services. In some cases the surface streets have been utilized as parallel frontage roads.

North of Dewey Square, Atlantic Avenue and Purchase Street form parallel frontage roads with ramps directly to and from the tunnel. These two streets connect with other local streets, but are limited in their usefulness because they extend for only four blocks through Downtown.

South of Dewey Square the tunnel is on an alignment which cuts diagonally across the grid pattern of surface streets. As a result the surface street pattern is ineffective in serving the collection and distribution functions which it was intended to serve.

Surface street changes have been proposed over the years to improve access between the tunnel and arterials, and to better serve new development. Closing segments of streets, directional changes, widening specific streets and new alignments for local streets have all been considered. Yet an effective overall plan continues to depend on changes to the deficiencies of the expressway system.

II.B.2 The Approaches to the Dewey Square Tunnel

The Artery Corridor immediately south of the Dewey Square Tunnel is the area where the effects of Dewey Square Tunnel problems are most seriously felt. Much of the congestion on this section is caused by the backup from the Dewey Square Tunnel. In addition, this area is critical because of the connections it provides between local streets, the Southeast Expressway, the Massachusetts Turnpike and Downtown.

Problems on the approaches to the Dewey Square Tunnel can be divided into two parts: those associated with the Massachusetts Turnpike interchange and

those on I-93 south of the interchange.

II.B.2.a The Massachusetts Pike Interchange

The Massachusetts Turnpike, built in 1965, connected to the Central Artery in the vicinity of South Station. The interchange was constructed on former rail yards, and property was taken from Chinatown to complete the ramp connections. Ramps were provided to connect to the Central Artery north and south, and to local streets such as Kneeland Street. These ramps were located in constricted space, as a result optimum geometric design could not be obtained.

The construction of this interchange connects with the Artery at the South portal of the Dewey Square Tunnel-- the main constriction of the South Area of the Artery Corridor. Volumes on the Turnpike in this area now approach 60,000 per day. More than half of the traffic is destined for the northbound roadway, requiring motorists to use the Dewey Square Tunnel or find alternative routes on local streets.

Capacity is the most serious problem at the Mass. Pike interchange. Volumes have been growing over time, and at present, the congestion in this area is one of the most serious in the Artery corridor. The capacity restriction is compounded by the lack of bypass facilities or parallel surface routes for spillover traffic.

II.B.2.b South of the Mass. Pike Interchange

The roadway section between the Mass. Pike interchange and the Massachusetts Avenue/Southeast Expressway is affected by the problems of the Dewey Square Tunnel and the Massachusetts Turnpike Interchange. Constructed as an elevated viaduct facility, this section is constrained by the lack of breakdown lanes, acceleration and deceleration lanes and adequate sight lines. As a

result there is serious congestion during much of the day. Frontage roads have been provided but they are not continuous along the full length of the roadway. They lead to surface roadways which are discontinuous and also congested.

Certain of the surface roadways lead into residential neighborhoods, resulting in serious traffic disruption to the communities along the South Area of the Corridor. Trucks--particularly those carrying dangerous cargoes--leave the Expressway on these surface streets and travel through residential streets and the edge of downtown, further adding to traffic operation problems and congestion. At the Massachusetts Avenue interchange with the Artery Northbound, a major ramp enters from the left, compounding the difficulties on the Artery. This interchange was designed for service to the Inner Belt, which is no longer planned for construction.

II.B.3 Related Problem Areas

The congestion of the South Area of the Artery Corridor causes many drivers to attempt to avoid this section of the expressway network. They do so by seeking local streets which do not have the degree of congestion which is usually present on the Artery. Limited alternatives are available for such spillover traffic. The three major points through which this spillover traffic must pass are: (1) the Massachusetts Avenue interchange; (2) Summer Street Bridge; (3) the Broadway Bridge.

II.B.3.a Massachusetts Avenue Interchange

The major operational problem at this interchange is the connection between the Southeast Expressway and the local arterial streets in the South End. At present, the interchange connects directly with directional ramps to and from the expressway to Massachusetts Avenue. This interchange was designed for interstate traffic onnecting to the proposed Inner Belt, which has been dropped from further consideration for construction.

It would have served traffic between expressways with 3 lanes in each direction; these lanes now provide a means for motorists to avoid the expressway network and travel through residential streets in the South End as alternative means of reaching Downtown.

II.B.3.b Summer Street Bridge

The Summer Street Bridge across the Fort Point Channel primarily serves access between Downtown and the industrial and residential areas of South Boston. Because it provides connections between several of the South Corridor major arterials and Downtown, it is used as a bypass route for traffic attempting to avoid the congestion of the expressway network , particularly during peak hours. The problems with it are that it is inadequate from a traffic operations viewpoint and it has heavy impacts on residential South Boston. It is not an adequate alternative or supplement to the Southeast Expressway connections in the south corridor. With expansion of the port activities in the South Boston portion of the Boston Naval Shipyard, and the expansion of associated truck traffic, the potential for additional truck traffic will add to the present transportation problems of Summer Street.

II.B.3.c Broadway Bridge

The Broadway Bridge is a part of the continuous parallel arterial street system in the south area adjacent to the Southeast Expressway. It forms a continuous link with Morrissey Boulevard, Old Colony Boulevard, Columbia Road and other arterials. It intersects the Artery corridor just south of the Dewey Square Tunnel. At this point, Broadway diminishes in capacity and system connections,

causing traffic to divert onto the Artery in order to connect with other principal arterials in the Downtown area. Traffic avoiding the Southeast Expressway using the series of parallel arterials must eventually cross the Broadway Bridge and either enter the Artery flow, or find alternative Downtown streets for connections.

II.C SOUTH AREA TRAFFIC CHARACTERISTICS

II.C.1 Data Base for Analysis

The Department of Public Works has collected hourly traffic volume data on the South Area portion of the Central Artery and its on- and off-ramps. The most recent data - for 1976 - have been used in traffic analyses and have been modified by new information collected in 1977 as part of the Southeast Expressway Downtown Express Bus Project. (See Figures 9, 10, and 11). From analyses of these data, the morning peak hours illustrate the worst traffic conditions on the Artery in the South Area. However, severe operational problems exist in the afternoon peak hours as well.

The following sections address: 1) service analysis; 2) traffic operations; 3) accidents; 4) delay.

II.C.2 Service Analysis

Theoretical capacity of each roadway of the main line South Area section has been determined to be 5530 vehicles per hour (vph). Methodology used to determine capacity was that recommended in the Highway Capacity Manual. In general, capacity is defined as "the maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or roadway in one direction during a specific period under prevailing roadway and traffic conditions." Under these theoretical volume conditions traffic flow on the facility is unstable, involving overall operating speeds in the neighborhood of 30-35 MPH with

Figure 9

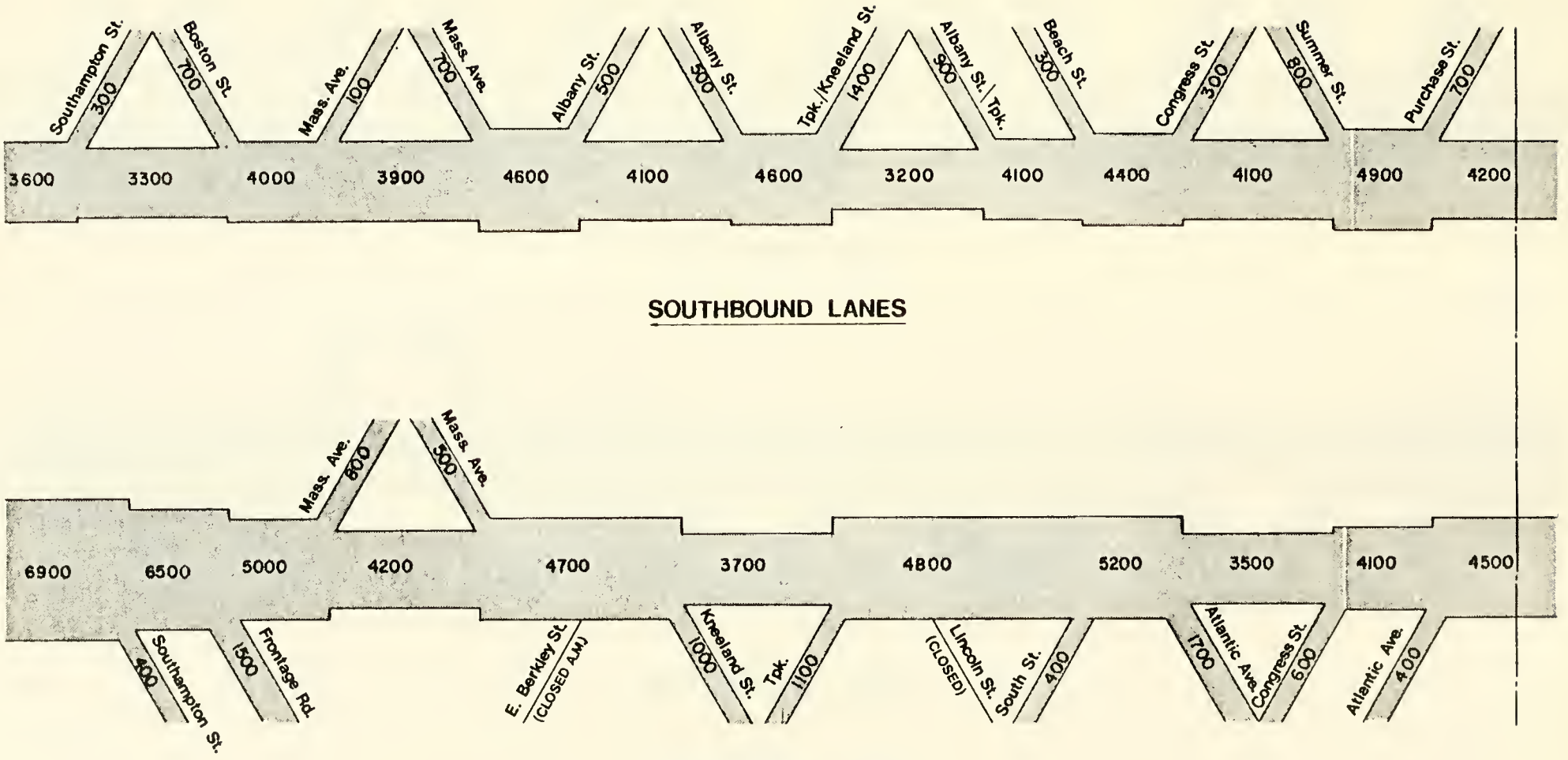
Average Daily Traffic (ADT) in South Area
Entering, Exiting and On the Artery

SOUTHBOUND

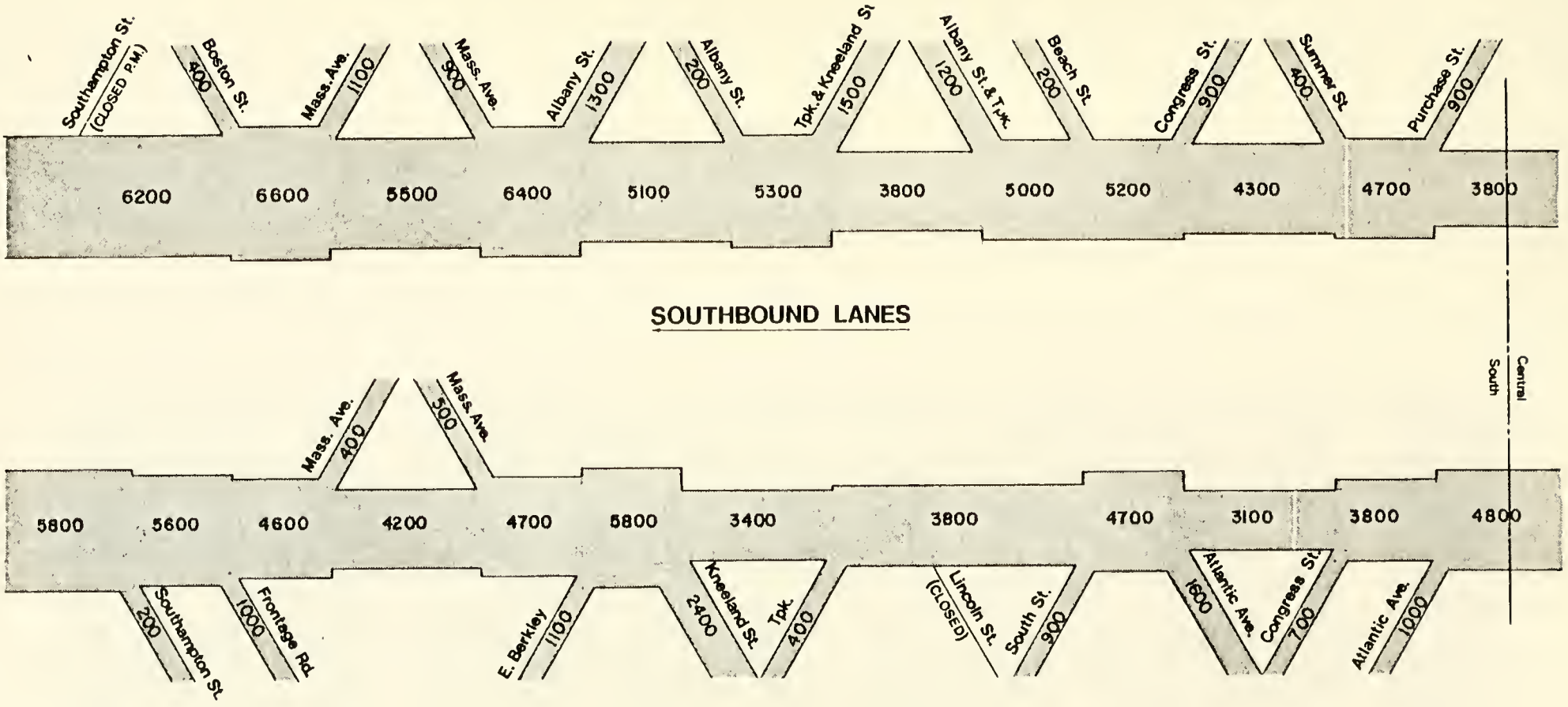
Location	Entering	Exiting	On Artery
South of High Street	-	-	57,100
Purchase Street Entrance	13,350	-	70,450
Summer Street Exit	-	8,900	61,550
Congress Street Ent.	5,350	-	66,900
Beach Street Exit	-	3,400	63,500
Albany St/Turnpike Exit	-	15,150	48,350
Kneeland St/Turnpike Ent.	16,000	-	64,350
Albany St. Exit	-	4,100	60,250
Albany St. Ent.	13,100	-	73,350
Mass. Avenue Exit	-	8,900	64,450
Mass. Avenue Ent.	3,050	-	
South of Mass. Avenue			67,500

NORTHBOUND

Location	Entering	Exiting	On Artery
South of Mass. Ave.	-	-	56,100
Mass. Avenue Exit	-	7,100	49,000
Mass. Avenue Ent.	5,850	-	54,850
E. Berkeley St. Ent.	8,450	-	63,300
Kneeland St/Turnpike Exit	-	16,900	46,400
Turnpike/Broadway Ent.	16,700	-	63,100
South Station Ent.	8,900	-	72,000
Northern Ave. Exit	-	16,000	
North of Northern Ave.			56,900



1976 A.M. PEAK Figure 10



1976 P.M. PEAK

Figure 11

momentary stoppage of traffic. Traffic flow within the hour will exhibit relatively little fluctuation. This condition on a highway is also defined as "Level of Service E".

The above discussion relates to a continuous section of a main line of a highway. In addition, investigation of specific locations at critical areas of a highway is necessary to identify bottlenecks or spots where capacity is reduced. Of particular importanc on the South Section is the grade of the roadway. At the extremes of both tunnel portals, the grade of the highway is approximately 15%. This has the effect of reducing capacity on the facility from 5530 vph to 4260 vph. Volumes on either roadway in excess of 4260 vph result in service deterioration from the previously noted Level of Service "E" - to a condition known as Level of Service "F" - forced flow, operation at low speeds (0-25 mph), highway acts as storage area, many stoppages.

Volumes between ramps in both the A.M. and P.M. peak periods approach or exceed theoretical capacity. This overloading of the main highway portion of the South Area is further compounded by entering and exiting ramp traffic. During peak hours this results in vehicles entering the main stream of traffic without the value of acceleration lanes. Conflicts result on both the main line and on ramps as queued ramp vehicles attempt multiple entry thereby compounding the conflicts. In most cases, vehicles exiting from the Artery must weave across entering vehicles due to the substandard spacing of ramps.

All these factors in combination, together with inadequate capacity to accommodate demand, result in the Artery operating under forced flow, Level of Service "F", during both A.M. and P.M. peaks. Operating speeds, measured for queue peak hours, were between 0 and 27 mph, (As measured during the Southeast Expressway Downtown Express Lane Project, April, 1977).

As a result of this capacity constraint, queues in excess of 1.5 miles in the a.m.

peak hours (7 a.m. to 9 a.m.) occur in the northbound lane of the South section of the Central Artery Corridor. This queue extends from the southern portal of the Dewey Square Tunnel to points south of the Massachusetts Avenue Interchange. It is a direct result of the heavy volumes of traffic entering the Central Artery from Massachusetts Avenue and the Massachusetts Turnpike.

During the A.M. peak period, operations on the Central Artery are forced flow, constant demand, interrupted traffic operations (stop-start), queues of up to 1.5 miles, and average running speed of 12 miles per hour. This illustrates a classic definition for level of service "F: (LS=F).

Queuing on the expressway causes dispersion of expressway traffic onto local streets that are already at or near capacity. This causes a substantial deterioration of service levels on local streets in the Central Artery corridor, as a result of congestion on the Lincoln Street off ramp in the Dewey Square tunnel was closed in 1972.

II.C.3 Traffic Operations

Because of the limiting conditions on the South Section (designed for 77,000 ADT and presently accommodating 135,000 ADT) traffic queues beyond the Massachusetts Avenue interchange in the northbound lanes during A.M.peaks, and similarly in the evening peaks, traffic queues congest the approaches to the tunnel from the north (the central section of the Central Artery). These operational deficiencies cause diversion of traffic to local streets not only in the South Section but also in the Central Section. Due to the lack of a through surface arterial network within the Artery Corridor, the diverted traffic together with local traffic causes severe traffic problems, backups, delays and accidents on streets contiguous to the Artery.

In those off-peak hours when speeds on the facility approach 45+ mph, the lack of acceleration lanes, short spacing between ramps, and high ramp entry and exit speeds introduce a hazardous situation on the Artery.

As there are not shoulders or storage lanes on the Artery, an incident such as a breakdown or accident causes roadway capacity to be reduced by at least one third. This further compounds not only Artery operations but also those on City streets in the vicinity of the South Area. When this occurs, particularly during peak hours, extensive delays occur on both Artery and the entire CBD. Shock waves extend along the Artery north or south of the incident affecting I-93, in some cases as far north as the Mystic Bridge.

II.C.4 Accidents

A review has been made of accident data occurring on the Central Artery in the South Area between Massachusetts Avenue and Northern Avenue. Both the north and southbound roadways and the associated exit and entrance ramps have been analyzed. The Accident Records System of the Department of Public Works was used to identify traffic accidents. Only "reportable" accidents are included. That is, the only accidents included in this report are those involving property damage (PDO) in excess of $200, an injury, or a fatality. Figure 12 presents 1975 accident data for the South Area.

Figure 12: I-93...South Area
1975 Accident Data

Total Accidents	449
Property Damage Only (PDO)	305
Fatal Accidents	3
Fatalities	3
Injury Accidents	144
Injuries	190
Multiple Vehicle Accidents	380
Total Vehicles Involved	914

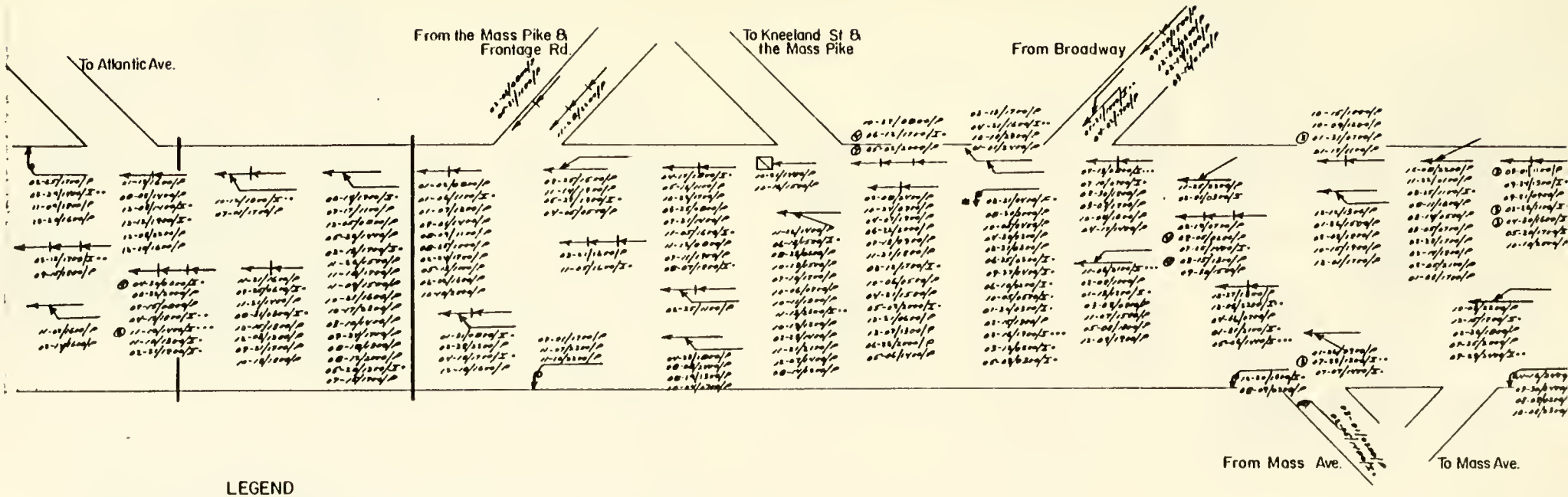
From Figure 12, the following comments can be made: 68% of the accidents are PDO accidents; 84% were multiple vehicle accidents with an average of two vehicles involved in each accident; and 32% of the accidents resulted in injuries.

In addition, between January 1973 and December 1976 there were eight fatal accidents resulting in eight fatalities. Three of the fatalities involved pedestrians; of the balance, three were multiple vehicle accidents and two were single vehicle accidents. All but one fatal accident occurred between 9 p.m. and 4 a.m.

Fatal injury producing accidents during off peak travel conditions (9 P.M. to 5 A.M.) have a corollary with injury accidents occurring during these hours. Of the 144 injury accidents, 50 (35%) happened during this time period, versus 26% of the PDO's. The incidence of injury producing accidents to PDO's was nearly 50% higher during off peak hours than from 5 A.M. to 9 P.M.

With substantially reduced volumes during this off-peak time, it is expected that, vehicle speeds will be higher, thereby increasing the probability of injury during a crash. However, this alone does not explain the fatalities and injuries during this time. The expected higher speeds, coupled with substandard geometrics of the roadway, i.e. no shoulders, limited length of acceleration and deceleration lanes, etc., appear to offer a more plausible reason for this higher incidence of severity of accidents.

As previously noted, the accidents shown in Figure 12 represent only reported accidents. Experience throughout the country has shown that only 20 to 40 percent of property damage-only accidents are normally reported to public authorities. Many researchers suggest that to compensate for this under-reporting, PDO accidents should be adjusted.

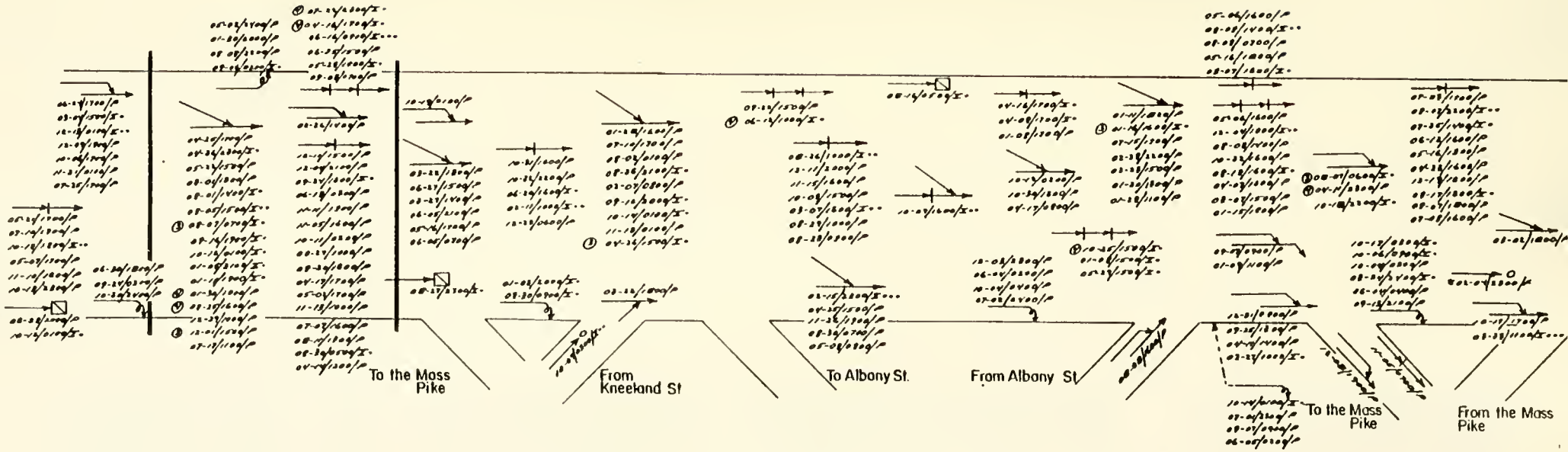


LEGEND

← K	Rear End
←	Angle
↶	Lost Control or Ran Off Road &/or Hit Fixed Object
•	Injury
*	Fatality
▨	Parked or Stalled Vehicle
O	Pedestrian
④	No. of Vehicles (if more than 3)
03/11	March 11, 1975
1700 (hrs)	5:00 p.m.
P	Property Damage
I	Injury

NOTE: Of the 449 identified accidents in the South Section of the Central Artery, 382 have been plotted (210 Northbound, 172 Southbound). There is insufficient data to plot the remaining 67 accidents. (i.e. Date, Specific Location, Type of Accident, Etc.)

COLLISION DIAGRAM: NORTH BOUND Figure 13



LEGEND

← K ←	Rear End
← ↙	Angle
√	Lost Control or Ran Off Road &/or Hit Fixed Object
●	Injury
*	Fatality
▨	Parked or Stalled Vehicle
O	Pedestrian
④	No. of Vehicles (if more than 3)
03/11	March 11, 1975
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NOTE: Of the 449 identified accidents in the South Section of the Central Artery, 382 have been plotted (210 Northbound, 172 Southbound). There is insufficient data to plot the remaining 67 accidents. (i.e. Date, Specific Location, Type of Accident, Etc.)

COLLISION DIAGRAM: SOUTH BOUND

Figure 14

In the absence of more precise information on the degree of under-reporting, multiplying the reported accidents by a factor of 2.5 (assuming a 40 percent reporting level) would yield a total of 904 accidents for the South section (760 PDO and 144 Injury).

The south section of the Central Artery clearly has demonstrated that a high hazard potential for accidents does exist.

II.C.5 Delay

Delay time has been analyzed for northbound traffic during the a.m. peak period since data was readily available from travel time data collected as a part of the Southeast Expressway Downtown Express Lane Project (April, 1977).

Average running speeds for this northbound section of the Central Artery are 18 miles per hour between the Massachusetts Avenue on-ramp and the Massachusetts Turnpike/ Kneeland Street off-ramp, and 23 miles per hour between the Turnpike/Kneeland Street off-ramp and the Atlantic Avenue off-ramp.

By increasing running speeds to 40 miles per hour on both of these sections of the Artery, total vehicle hours of delay would be reduced by 172,000 hours on an annual basis. This figure assumes only weekdays and a forty week year as a basis for computing annual a.m. peak period delay (7:00 a.m. to 9:00 a.m.).

II.D ENVIRONMENTAL CONDITIONS

II.D.1 Existing Air Quality

The most important source of existing carbon monoxide, hydrocarbons and oxides of nitrogen in the South Area is traffic, both on local streets and on the portion of the Central Artery which traverses the area. Traffic volumes using local streets contribute a large percentage of existing CO and hydrocarbons, because this traffic

travels at slow speeds in stop-and-go conditions during the daytime, directly adjacent to businesses, office buildings and other developed areas. The Artery itself is located in tunnel for about 2500 feet, or about 30 percent of its length through the South Area. The section in tunnel is ventilated by means of four stacks located in the vicinity of South Station; these act as point sources of automotive pollutants to the surrounding areas.

A measurement program designed to monitor background CO levels in the study area was undertaken as part of the 1975 South Station Urban Renewal Project Environmental Impact Report.* Two monitoring stations were selected--one located directly across Atlantic Avenue from South Station, and one located in the middle of the rail yards behind the South Postal Annex. Continuous measurements of CO concentration, wind speed, and wind direction were recorded over a three-month period (October-December 1974). Figure 15 presents the highest 1-hour and 8-hour CO concentrations recorded at the 2 sites in each of three months, and compares them with the National Ambient Air Quality Standards established for Carbon Monoxide.

Figure 15: Measured CO Levels, (ppm)
South Area

	1-hour	8-hour
National Ambient Air Quality Standard	35	9
South Station Site		
October	6.3	5.1
November	11.9	7.4
December	11.3	7.5
Rail Yards Site		
October	7.1	6.5
November	14.3	9.1
December	8.9	6.1

* "Air Quality Technical Support Document to the Environmental Impact Report--South Station Urban Renewal Project", ERT, Inc., May 1975.

The results of the measurement program suggest that the 1-hour CO standard is not likely to be exceeded unless conditions in the area change dramatically as a result of the proposed project. Such a radical change in traffic volumes or roadway configuration is not anticipated. The 8-hour standard was exceeded once during the measurement period, however, and is probably the critical standard to consider in analyzing air quality impacts of proposed South Area changes.

As an additional method of quantifying the pollutant contribution of the existing Artery, calculations of 1975 gross pollutant emissions for CO, HC and NO_x were carried out for the South Section main line and ramps. Emissions factors used for this analysis were average emissions factors for 1975 from EPA's Compilation document, Supplement 5(1975). The emissions factors were speed-corrected to correspond to the predicted speeds on individual links. Total vehicle-miles of travel were calculated for the existing Artery main line and ramps only (i.e., not including local streets and arterials), using 1975 traffic volumes; these were used to produce pollutant burden estimates, in tons per year of pollutants emitted. The resulting estimates are presented in Figure 16 below.

Figure 16: 1975 Gross Pollutant Emissions--Central Artery South, with Ramps

Pollutant	Emissions, tons/year
CO	4620
HC	730
NO_x	1450

II.D.2 Existing Noise Climate

The noise climate along the South Segment, as along the entire length of the Central Artery, is created primarily by the dense city traffic which traverses the area, both on the Artery itself and on local streets and arterials in the vicinity of the Artery. The expressway is already depressed and covered through about half the length of the South Section. Traffic flowing through this tunnel section is still audible to an observer standing near an entrance or exit ramp on the pavement above. It sets the background noise level, but it does not represent a source of obvious, intrusive noise levels above the background at these locations. Nevertheless, peak and L10 noise levels in areas where the expressway is depressed tend to be as high as those where the road is at or above ground level. This is because the Artery is only one of a multitude of major noise sources, which taken together, create the "urban din". It is characteristic of such noisy urban situations that changes in the source strength (e.g., traffic volumes, speeds) or the geometric configuration (e.g., elevated, depressed) of any one source tend to produce little variation in the overall noise level, provided the other noise sources remain unchanged. In addition to traffic-generated noise, industrial activities associated with the nearby rail yards, the South Postal Annex operations and other activities in the Fort Point Channel area contribute substantially to relazively high areawide noise levels.

Where the expressway is visible in the South Area, it tends to be bordered by high-rise office buildings, industrial uses, or vacant or undeveloped land. During the daytime, especially during the morning and evening peaks, traffic on local streets and surface arterials is the predominant contributor to ambient noise at the first - and second-story levels of most buildings. This is because the local streets are much closer to observers on the first several floors than is the expressway. At

higher levels of multi-story buildings abutting the unshielded right-of-way, the effect of the higher traffic volumes on the Artery becomes more important. At night, traffic on local streets tends to decrease, so that expressway traffic noise is dominant at all levels of adjacent buildings. The importance of this tendency is mitigated by the fact that almost all nearby buildings are business or industrial locations, air conditioned during the daytime (i.e., having closed windows) and/or unoccupied at night.

In general, it can be said that existing noise levels in the South Area are quite high; however, they are not unusual or inappropriate for an urban industrial/commercial location. The surrounding land uses tend to be relatively insensitive to what might constitute severely annoying noise levels in a residential or suburban location. The only area potentially sensitive to changes in noise climate resulting from modifications to the Artery in the South Area is the large Chinese residential community located west of the Artery, directly adjacent to the interchange with the Mass. Turnpike.

Measurements of existing noise levels in the South Area corridor were made as part of two recent studies: the 1975 Central Artery Feasibility Study sponsored by the Boston Redevelopment Authority, and the 1976 South Station Urban Renewal Project Environmental Impact Report. Figure 17 describes seven measurement sites located in the South Area, and presents the L10, L50 and L90 noise levels for those sites reported in either of the two studies ("L10" represents the noise level in DBA exceeded 10 percent of the time; "L50" and "L90" are similar percentile levels).

The most noteworthy aspects of the measurement data are:

1. The consistently high noise levels; L10 exceeds the Federal Highway Design Noise Level of 70 dBA (for residential land uses) in all cases.
2. The narrow range of noise level fluctuations: only in one case is the difference between the reported L10 and L90 level greater than 10 dBA. This signifies that a high "noise floor", or ambient noise level, exists throughout the area, created by a multitude of sources. Modifications to any single source will not produce any significant change in background noise levels.

Figure 17: MEASUREMENTS OF EXISTING NOISE LEVELS, 1975 and 1976

Location	Time of Day	Measured Noise Levels, dBA L10	L50	L90
1. Atlantic Ave., between Dewey Sq., & Essex St. *	8:00AM	74	70	66
2. Pedestrian walkway over Expwy. before tunnel ent. at Congress St. *	8:30AM	82	79	76
3. Congress St. over tunnel entrance between Atlantic Avenue & Purchase St. *	7:20AM	78	73	70
4. Bridge over Fort Point Channel on Congress St. *	7:20AM	72	66	62
5. Hotel Essex, facing Atlantic Ave.**	4-4:30PM	76	72	67
6. Kneeland St. & Atlantic Avenue **	10-12 AM	77	68	66
7. South Station -southern end of rail yard **	6-8:30AM	72	66	65

*Source: Memo from Klaus Kleinschmidt, Cambridge Acoustical Associates, to David Wallace, Wallace, Floyd, Ellenzweig, Moore Inc., re Central Artery Noise Survey, April 26, 1977.

**Source: "Noise Analysis Technical Support Document to the Environmental Impact Report--South Station Urban Renewal Project", prepared by Environmental Research & Technology Inc., May 1976.

II.D.3 Water Quality

The Fort Point Channel is a tidal waterway discharging to Boston Harbor and having a tributary drainage area of about 2700 urban acres. It is 350 feet wide and, as an inlet of the Harbor, has the same tidal fluctuations. The mean tidal range for Boston Harbor is 9.4 feet with mean sea level at 5.65 feet above the Boston City Base Datum. Tidal peaks occur in Fort Point Channel approximately 5 minutes later than in Boston Harbor.

The quality of the water in the Fort Point Channel has been recognized as objectionable in documentation dating back at least to 1936. The present water quality classification is given as "SC" for the Channel as well as the remainder of the Inner Harbor. Previous studies have observed and sampled sludge deposits in the Fort Point Channel of more than 3 feet deep, containing oily residues and emitting foul odors.[1] Oily muck completely paves the Fort Point Channel bottom with a minimum of 6 inches in thickness. This condition is unlike anything else in Boston Harbor. Absolutely no marine life is present.[2] Measurements of water quality taken in 1972 are included in Figure 18. These measurements indicate a very poor water quality at the mouth of the Channel. The indications from all recent studies are than anaerobic conditions exist in the sediments of the Channel. The surface water

1. Biological Aspects of Water Quality-Charles River and Boston Harbor, Massachusetts, performed by the Federal Water Pollution Control Administration of the U.S. Department of the Interior, 1967.

2. Structural Evaluations and Ecological Observations in Boston Harbor, prepared by TCE, Inc., for the Metropolitan District Commission, 1973.

overlaying these sediments is grossly polluted as a result of stormwater overflow discharges, as well as possible contamination from continuous dry-weather flows in the stormwater overflow structures. Unauthorized dumping of oil materials into the Channel is also apparent, although the source of the dumpings is not presently known.[3]

Figure 18: Boston Harbor Water Quality Survey
Station #39 - Fort Point Channel
(Mouth of Channel)

Sample No.	R54939	R55111	R55471	R55715	R55878
Date of collection	6/20/72	7/18/72	8/15/72	9/12/72	10/17/72
Time of collection	2:20pm	10:55am	11:40am	10:15am	10:25am
Temperature, deg F	-	-	-	-	56
Low Tide	1:15pm	11:37am	10:07am	8:47am	12:24pm
BOD	2.8	2.7	3.4	2.6	2.8
pH	7.8	7.6	7.7	7.7	7.7
Alkalinity-Total	84	108	102	107	103
DO	3.8	6.2	6.2	1.3	4.2
Chlorides	10,800	14,000	15,000	15,400	
Total solids	-	-	-	-	-
Susp. solids-Total	6.5	1.5	-	1.5	1.0
Loss	-	-	-	-	-
Total P	0.30	0.16	0.10	0.18	0.18
Coliform-Total	460,000	150,000	24,000	-	240,000
Fecal	460,000	93,000	2,400	-	93,000
Color	45	20	15	18	10
Turbidity	1	1	1	1	0
Total-Kj-N	2.2	1.0	-	-	-
Ammonia-N	0.38	0.5	0.31	0.26	0.38
Nitrite-N	-	-	-	-	-
Nitrate-N	0.1	0.0	0.0	0.0	0.0

Source: Commonwealth of Massachusetts, Division of Water Pollution Control, Metropolitan Regional Office, April, 1975.

At present there are several identifiable sources of quality degredation in the Fort Point Channel. Principal sources of pollution exist because many of the outfalls in the Channel are connected to one of the oldest sewer collection systems in this country.

3. A pollution Survey of Boston Harbor, prepared by the Massachusetts Water Resources Commission, Division of Water Pollution Control, April, 1975.

The downtown area is served by the Boston Main Drainage System, which is a very old combined sewer system which includes intercepting sewers along the waterfront. These interceptors discharge to the MDC Main Drainage tunnel to the Deer Island Treatment Facility. Trunk sewers from the collection system discharge dry-weather flows into these interceptors through regulators and pass storm flows into the harbor through tide-gated outlet structures. A recent study identifies six such locations in the Fort Point Channel.[4]

An additional source of storm water overflow is the Roxbury Canal-Dorchester Brook Conduit, at the head of the channel. This is a twin 240" X 186" reinforced concrete storm wazer conduit with a rated capacity of nearly 3,500 cfs into the Channel. It was designed to accomodate a 50-year frequency storm.

The City of Boston has proposed construction of increased capacity intercepting sewers, including a new interceptor, called the Fort Point Channel Interceptor, located along the west side of the Channel.[5] The 1975 study recommended a decentralized overflow system, including a new facility for the Fort Point Channel.[4] This new facility would connect all the discharge locations in the Fort Point Channel by conduits to transport overflows to a regulation facility for treatment and discharge into the Channel. The Fort Point Channel facility would be located in the vicinity of the Roxbury Canal-Dorchester Brook Conduit and treat the overflows from the East Side Interceptor and overflow structures. None of the proposed facilities have reached the point of programming for implementation, nor have final designs for the facilities been drafted.

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4. Eastern Mass. Metropolitan Area Wastewater Engineering and Management Plan for Boston Harbor, prepared by Metcalf and Eddy for the U.S. Corps. of Engineers and the Metropolitan District Commission, 1975.

5. Improvements to the Boston Main Drainage System, Camp Dresser and McKee, September, 1967.

CHAPTER III: ALTERNATIVES FOR IMPROVEMENT

During the past two decades, numerous plans have been proposed for improving the Artery. Some improvements have been implemented, but most of the plans have become documents for library shelves. Numerous studies for major improvements of related projects have also been undertaken, often without reference to the manner in which the Artery operates as part of a larger system of transportation service.

III.A PAST EFFORTS

Previous studies on the South Area of the Artery Corridor have been numerous. They are summarized in Appendix I. The general trend of past studies has been to add facilities to the existing network, without altering the pattern of the present highway facilities. These studies have been summarized below in two groups- alternatives outside the present Artery Corridor, and alternatives within the present Corridor.

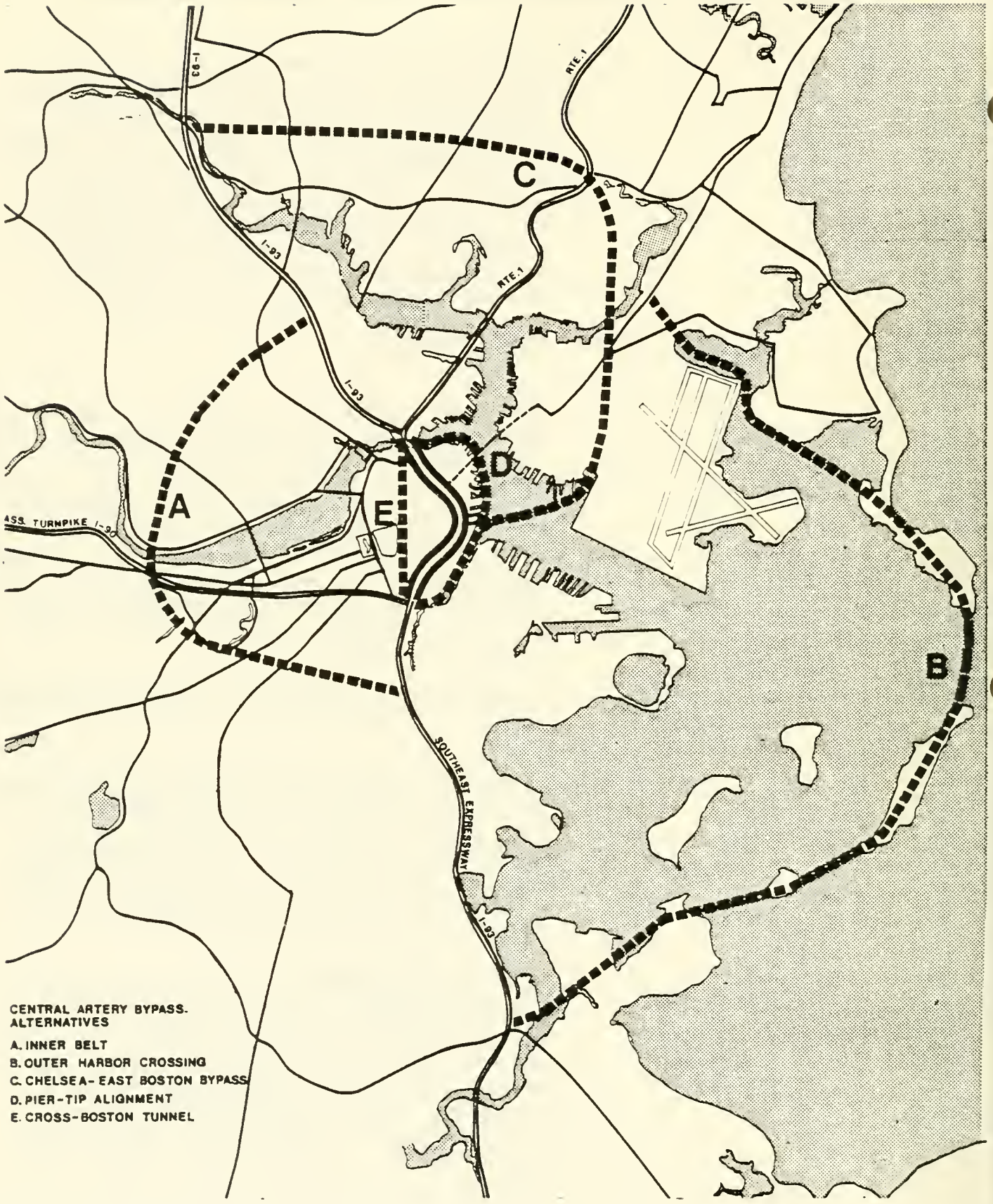
III.A.1 Alternatives outside the Artery Corridor

There have been several concepts for bypassing the Artery completely in order to avoid the difficult problems of serving both local and through traffic on the same facility. These have been dropped from further consideration for various reasons. The alternatives are as follows: (See Figure 19)

A. The Inner Belt

The philosophy of a radial expressway and inner belt highway system was presented in the Master Plan for Highways in the Boston Metropolitan Area in 1948, and was adopted by the Commonwealth as a basis for long-range improvement to area highways. The Central Artery was a portion of the Inner Belt under this plan.

The basic functions of the Inner Belt were: (a) to serve as a collector-distributor of traffic in the Core Area and (b) to interconnect radial expressways for traffic wizh an origin or destination either in metropolitan Boston or on any part of the interstate highway system.



ALTERNATIVES TO THE ARTERY CORRIDOR

Figure 19

As a partial result of this plan, the Central Artery was constructed. To complete the Belt, a series of 30 alternatives were studied and 10 were examined in detail. However, in 1971, Governor Sargent made the decision not to proceed with further plans for the Inner Belt, for these major reasons:

a. Extensive residential takings in Somerville and Cambridge and inability to meet the relocation requirements, which had become more stringent since initial plans were put forth.

b. Major disruption to communities along the corridor of the proposed highway, to which local municipal officials had become opposed.

c. Community protest over the scale, location, impacts and costs of the proposed Inner Belt.

d. Technical questions resulting from re-examination of the traffic projections and the ability of connecting radials, including the Central Artery to accomodate projected volumes and movements.

e. Increased highway construction was considered to be counterproductive because it would generate traffic for the core area of Boston, which cannot accommodate present traffic and parking demands.

Since the Governor's decision, funds previously allocated to the Inner Belt have become part of the Massachusetts Interstate Transfer. In addition, the Commonwealth's transportation policy and decisions about specific facilities have reinforced the determination that the Inner Belt is no longer a feasible, desirable or prudent alternative, nor is it politically acceptable.

B. Outer Harbor Crossing

As early as the 1930's, a highway to connect between Route 1-A on the north and the area south of the core was examined. This was later reviewed and studied by the Boston Transportation Planning Review as a connection between Route 1-A and the Southeast Expressway. The proposed facility used the harbor island for its route, in

a combination of bridges and surface facilities. A major crossing of the shipping channel leading to and from Boston Harbor was included. While the alternative of a tunnel was suggested for this crossing, problems of interference with the shipping channel along with anticipated costs of construction precluded it from further consideration. The proposed bridge was similarly difficult; under-clearance requirements for shipping made the bridge a hazard for Logan Airport flight path clearance standards. In addition the proposed approach roads would have violated Section 4(f) provisions in utilizing islands, wetlands and publicly owned land along the proposed alignment.

While this alternative would have provided connections for two major expressways and a bypass for the Central Artery, it did not provide connections and distribution to the various sections of the region, and it did not provide adequately for downtown collection and distribution. Access to the Airport was also constrained by the need for interchange of traffic in either the residential or open space areas of East Boston. While it may well have resulted in new origins and destinations it did not address the problem of the existing traffic overloads on the Central Artery, as traffic was not diverted from the Artery.

C. Chelsea-East Boston Bypass

Another alternative investigated in 1971 was a downtown bypass from I-93 on the north, through Chelsea to East Boston and the Airport and in a tunnel under the harbor, to connect to the Southeast Expressway-Mass Pike interchange at the south edge of downtown. This alternative was conceived as part of plans then being considered for I-95 north through Lynn, and I-95 relocated through East Boston and Revere. It was intended to address the problem of how traffic on the north from both I-93 and proposed I-95 could get access to the Airport and around Downtown for non-core destinations. The bypass was also directly related to a proposed general purpose Third Harbor Crossing between East Boston and the Fort Point Channel area in South Boston,

and in fact incorporated this tunnel as a major element of its alignment.

Early analysis of this alternative showed that the proposed alignment had a number of major problems of feasibility. The proposal would have required either a new alignment or a narrow rail right-of-way in the Everett/Chelsea area which would have caused substantial residential property takings and impacts on local neighborhoods. The Chelsea Creek crossing was complicated by the need to retain shipping access to the oil terminals located at the head of the Creek. In East Boston, major conflicts with expressway and local circulation, along with substantial impacts on the adjacent residential community were also found. The location through either East Boston or the Airport was another major problem. This was later resolved by a decision to use Airport property for connections to the proposed Third Harbor Crossing. Because of impacts of this alignment, longer tunnels were discussed, but the costs and potential impacts were prohibitive. In addition, because of the lack of direct connection to I-93, the over-capacity conditions on the Central Artery would have remained.

After preliminary analysis and strong community objections to the alignment, this proposal was dropped. Its dependence on I-95 through Lynn, and relocated I-95 through East Boston and Revere became apparent, and both of these alternatives were dropped from further consideration by the Commonwealth. The Third Harbor Crossing portion of the alignment remained as a viable portion of the proposed connection - not as a bypass of the Central Artery, but for service directly to and from the Airport.

D. Pier-Tip Bypass

After analysis of alternatives outside the main core area of Boston, other alignments closer to Downtown were investigated. A pier-tip bypass was proposed, connecting between the junction of the Mystic Bridge and I-93 on the north and the junction of the Mass. Pike and the Southeast Expressway on the south, and using the harbor bottom as the

right-of-way along the ends of the downtown piers. The alternative's advantages were: (a) construction of a new facility without disturbing traffic in the heart of the city; (b) a right-of-way which would be "free" and which would afford relative ease of construction; (c) the potential for separation of local and through traffic with the existing Artery retained for the collection and distribution of traffic in Downtown Boston.

However, this alternative did not address the problem of providing improved access between major expressways and the Airport because it could not connect directly with the existing tunnels and the proposed Third Harbor Crossing. This became a major deficiency, because the pier-tip tunnel would only serve north-south through traffic and not meet major demands for access between expressways and either the Airport or Downtown. Problems with the physical feasibility included grades of the connections on either end, possible interference with shipping in the harbor during construction, plus the logistical problems of constructing a long tunnel entirely under water, with attendant difficulties of getting approvals for the filling required to construct the tunnel.

Because of its prohibitive costs and environmental impacts, it was decided that the alternative was not feasible, and it was dropped from further study.

E. Cross-Boston Tunnel

The last of the alternatives that would bypass the corridor of the existing Central Artery was a proposal advanced in 1974 for construction of a deep-bore tunnel to connect directly from the Mystic Bridge I-93 intersection on the north to the Southeast Expressway and Mass. Pike interchange on the south. The elements of this proposal included an additional short tunnel connecting from the north to the entrance of the Sumner/Callahan Tunnels on an alignment directly under the existing

Artery to serve airport traffic. It was proposed that, following construction, the Artery could be removed and the corridor used as a major arterial street providing access to Downtown locations.

The advantages cited included: (a) the length of the tunnel, which would be the shortest possible connection between major regional expressways; (b) construction would not be entirely in the Artery corridor (other alternatives being considered at the time used the existing Artery corridor for a new facility); (c) preliminary examination indicated that overall construction impacts would be significant, but less than other alternatives.

The proposal had several major drawbacks: (a) its common weakness shared with other past proposals was its inability to deal with the role of the Central Artery as a downtown collector and distributor of traffic, though it did have the advantage of exclusive access to the Sumner/Callahan Tunnels; (b) the proposed arterial street could not adequately meet existing collection and distribution demands in the Downtown area. It would have produced spillover traffic on local streets, with impacts on adjacent residential and business areas; (c) there are serious questions of feasibility that a highway rising from a deep-bore tunnel across Downtown Boston could meet the necessary vertical clearance requirements to cross the Charles River without constructing a massive, multi-tiered interchange in the North Station area; (d) sub-surface conditions in the area of the proposed tunnel may be such that this alternative is technically infeasible. Construction problems near and under large buildings, utilities and subway tunnels were major. (e) the proposed tunnel would have required installation of extensive ventilation equipment to meet present and future air quality standards. The location of ventilation structures and the impact of the exhaust disposed through ventilation structures would have produced major negative impacts on Downtown. For all of these reasons, this alternative was dropped from further study.

III.A.2 Corridor Retention

The analysis of alternatives to bypass the corridor of the present Central Artery has been instructive on several points:

1. Alternative alignments for the relocation of all or part of the present functions of the Artery cannot be easily found. Alternatives which have been presented and examined in some detail have the disadvantages of not replacing or relocating the functions of the Artery, and not substantially easing its present problems.
2. High costs are incurred in all of the alternatives to the present Artery corridor, both in terms of funding the construction and operations on adjacent neighborhoods.
3. The present Artery would have to be retained in virtually all instances as a collection and distribution facility for Downtown, and in most instances for Airport access via the Sumner/Callahan Tunnels as well.
4. Improvements to the present facility would be required in all alternatives. Safety considerations and the aging structure of the present facility must be dealt with at some future date. Simply eliminating the present Artery without adequately providing for its present functions is not a solution to transportation needs.
5. All of the alternatives to the present Artery tried to find means of avoiding the problems associated with construction of a new facility in the present Artery Corridor while maintaining traffic. However, the present corridor of the Central Artery is the only alignment which affords all the advantages of connections between the radial regional expressway network. In addition, it is the only alignment which provides collection and distribution into the regionally important downtown area. It thus appears that the present Artery corridor must be retained for these functions.

III.B ALTERNATIVES WITHIN THE PRESENT CORRIDOR

The South Area of the Artery Corridor contains highly valued land areas and neighborhoods which form major constraints on the selection of alternatives for improvement to the highways in the area. At the same time, these areas define the corridor locations in which opportunities are presented for highway improvements. Because of the efforts already underway to preserve and enhance several of these areas they have been listed below as the setting for further examination of alternatives.

III.B.1 South Area Highway Planning Context

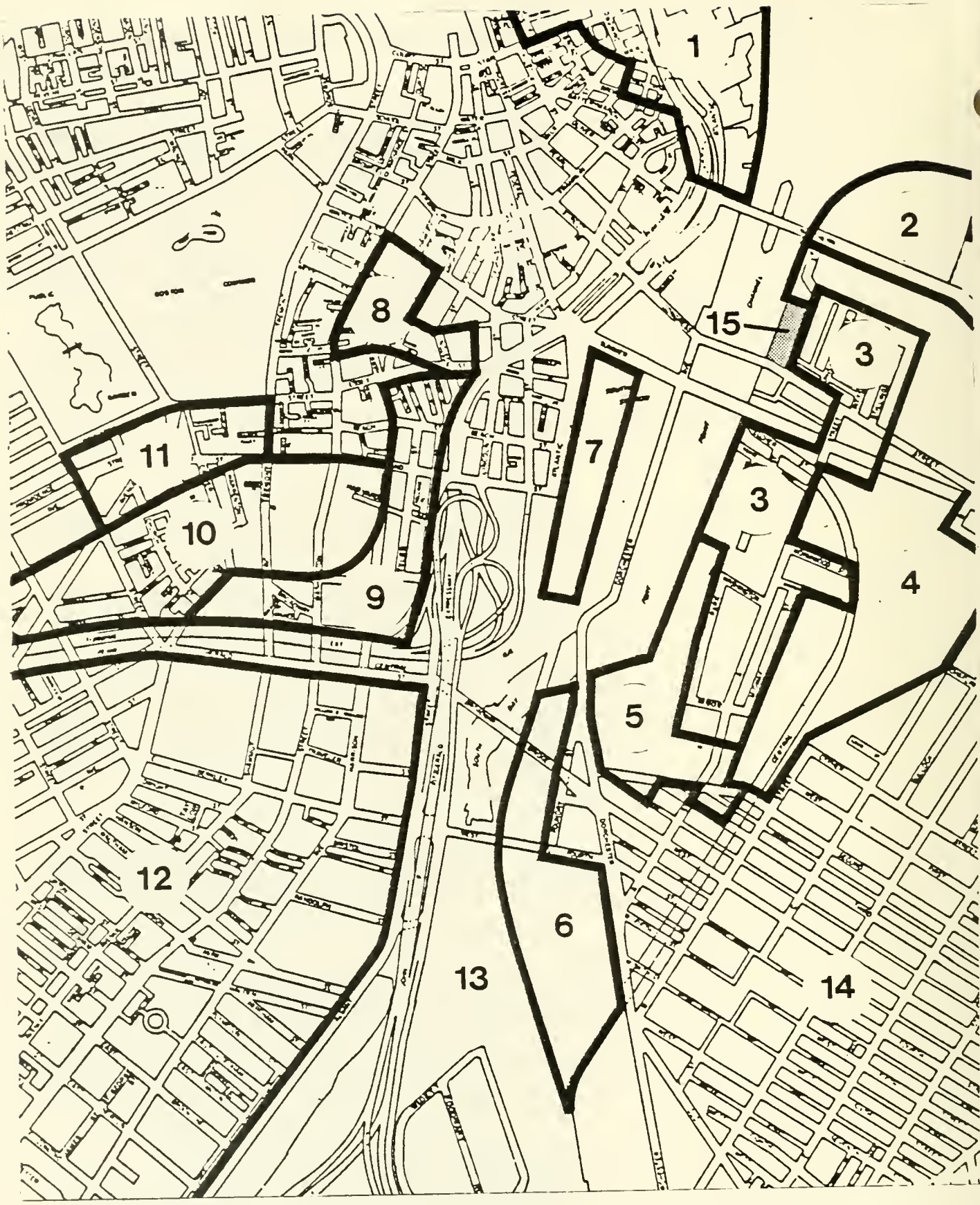
Each of the efforts listed below is identified on Figure 20 by the numerical designation which appears in the text.

1. Waterfront Urban Renewal Project
The bulk of this project falls in the Central Area of the Corridor, but several of the South Area improvements would affect development and parcels in the southerly portion of the project area. Specifically, this area includes the Harbor Towers apartment development and several waterside parcels not yet developed.

2. The Fan Pier - Athanas Properties
A large-scale private development on the Fan Pier and adjacent waterfront lands has been discussed; plans include apartment and marina activities.

3. Town and City Properties, Ltd.
Many of the existing structures - principally large warehouse structures - are planned for rehabilitation for new commercial uses. The redevelopment of the area is already in progress with some small-scale rehabilitation.

4. Railroad Properties
This land, recently offered for sale by the Penn Central Railroad Company, is largely vacant, with some residual railroad uses. Part of the area is scheduled for transportation improvements, including the re-aligned Northern Avenue approaches to a new Fort Point Channel bridge.



RELATED PLANNING EFFORTS

Figure 20

The right-of-way for the proposed Seaport Access Road would also potentially use portions of this land.

5. Gillette Company

A large manufacturing plant for the Gillette Company occupies a site on the Fort Point Channel. This plant is a chief location for the manufacturing of razor blades.

6. Cabot Yards

The MBTA has constructed a new facility for the maintenance and storage of its Red Line rapid transit vehicles on this site. The facility also includes a major bus storage and maintenance area.

7. South Station Transportation Center

Major plans for this site have been developed to construct a multi-modal transportation interchange facility, which will include intercity rail and bus, rail and bus commuter lines and parking.

8. Lafayette Place

This area has been designated for new commercial development, including expansion of the area occupied by the Jordan Marsh Department Store, and additional commercial space to be constructed adjacent. Street changes include a new Essex Street which will connect directly with the Artery corridor.

9. Chinatown

The long-established Chinese Community is based in this area. Shops, apartments and cultural facilities continue this focus. A new school and new apartments have strengthened the community in recent years.

10. South Cove Urban Renewal Area

This project has provided space for the expansion of the Tufts-New England Medical Center and includes the small community known as Bay Village.

11. Park Plaza

Recent City efforts have led to a plan for a multiple use area which will include retail activities, government and private offices and apartment units.

12. South End Urban Renewal Area

This large neighborhood has been the location of major urban renewal efforts over the past years. Many of these efforts have been directed toward strengthening the residential character of the area. Both public and private efforts have resulted in the restoration of structures and the enhancement of the community.

13. South Bay

This area is the location of a new maintenance facility constructed by the City of Boston, and is the site of the Wholesale Food Market. Residual railroad facilities are also found here.

14. South Boston

This area is a stable residential community which contains manufacturing and shipping concerns. Truck traffic on residential streets is being addressed through planning of the Seaport Access Road.

15. Museum Wharf

This location is the new home of the Children's Museum and the Museum of Transportation. A former wharf building, it will be rehabilitated for museum use and will be partially opened in the fall of 1977.

III.B.2 Constrained Alternatives

The functions of areas through which the Artery passes severely constrain alternatives which may be chosen for improvement. Early analysis of the potential impacts of feasible highway improvement has resulted in dropping two alternatives. They are:

1. Double-decking of the present facility.

   This option has been dropped because of impacts on adjacent areas, including buildings that are proximate to the Artery,

particularly in the congested areas around the Dewey Square Tunnel; difficult design and engineering problems of connecting the tunnel and upper roadway to other expressways and local streets without extensive land damages; additional lanes, which would be provided by the doubledecking, may be unwarranted and in conflict with regional transit and air quality control plans; additional vertical construction would serve to further deteriorate the environment.

2. Widening the Dewey Square Tunnel.

Widening of the existing tunnel has been examined as a possibility of increasing capacity of the highway system at the point which is now the chief bottleneck. If undertaken, widening would consist of adding lanes on both sides of the existing tunnel, to act as subsurface frontage roads for the existing tunnel.

North of Dewey Square, widening could be undertaken beneath existing parallel surface streets, but replacement of existing ramp access would be difficult without land takings.

South of Dewey Square, widening on both sides of the tunnel would require taking buildings along virtually the entire rigth-of-way. The Chinese Merchants' Building, partially taken in construction of the tunnel in 1954-59, would be required to be taken in its entirety, along with adjacent shops. Two large parking garages - one with office use on the top floors - would be taken. Two structures occupying entire city blocks and housing offices, shops and warehous activities would also be taken.

This option has been dropped as a potential solution because of impacts on adjacent areas and buildings and the difficult design and engineering problems at ramps and connections to other expressways. Outside the Dewey Square tunnel (south of Kneeland Street) widening of the existing highway facility remains a possible improvement.

III.C ALTERNATIVES FOR FURTHER STUDY

Based on the previous studies in this part of the metropolitan area and the constraints which limit alternatives for South Area highway improvements, several new alternatives have been identified within the context of other proposed highway improvements. These have assisted in formulating potential improvements for the South Area and can either be undertaken singly, or in conjunction with other proposed improvements.

III.C.1 Relationship to other potential projects

In the densely built-up core area, it is difficult to find rights-of-way for new highways to improve the regional network. It is the Commonwealth's policy to expand the transit network for core-oriented trips and to improve highway service for trips that cannot be served by transit. While the transit network can be expanded to improve the regional population's access into the core of the region, it cannot be expected to displace the need for maintaining adequate highway service to and through the core.

The potential projects which influence decisions in the South Area of the Artery Corridor are:

1. The proposed improvements in the Central Area of the Artery Corridor.
2. The proposed Third Harbor Tunnel between Downtown and Logan Airport. If constructed, this project would connect only to Logan Airport. It has two possible forms of service:
   a. A special purpose tunnel, serving only buses, trucks, taxis and emergency vehicles to and from the Airport.
   b. A general purpose tunnel serving all types of vehicles to and from the Airport.
3. The proposed rail connection between North Station and South Station. This proposal is applicable only to the alternatives which link to the Central Area of the Artery Corridor.

III.C.2 Separability of the South Area

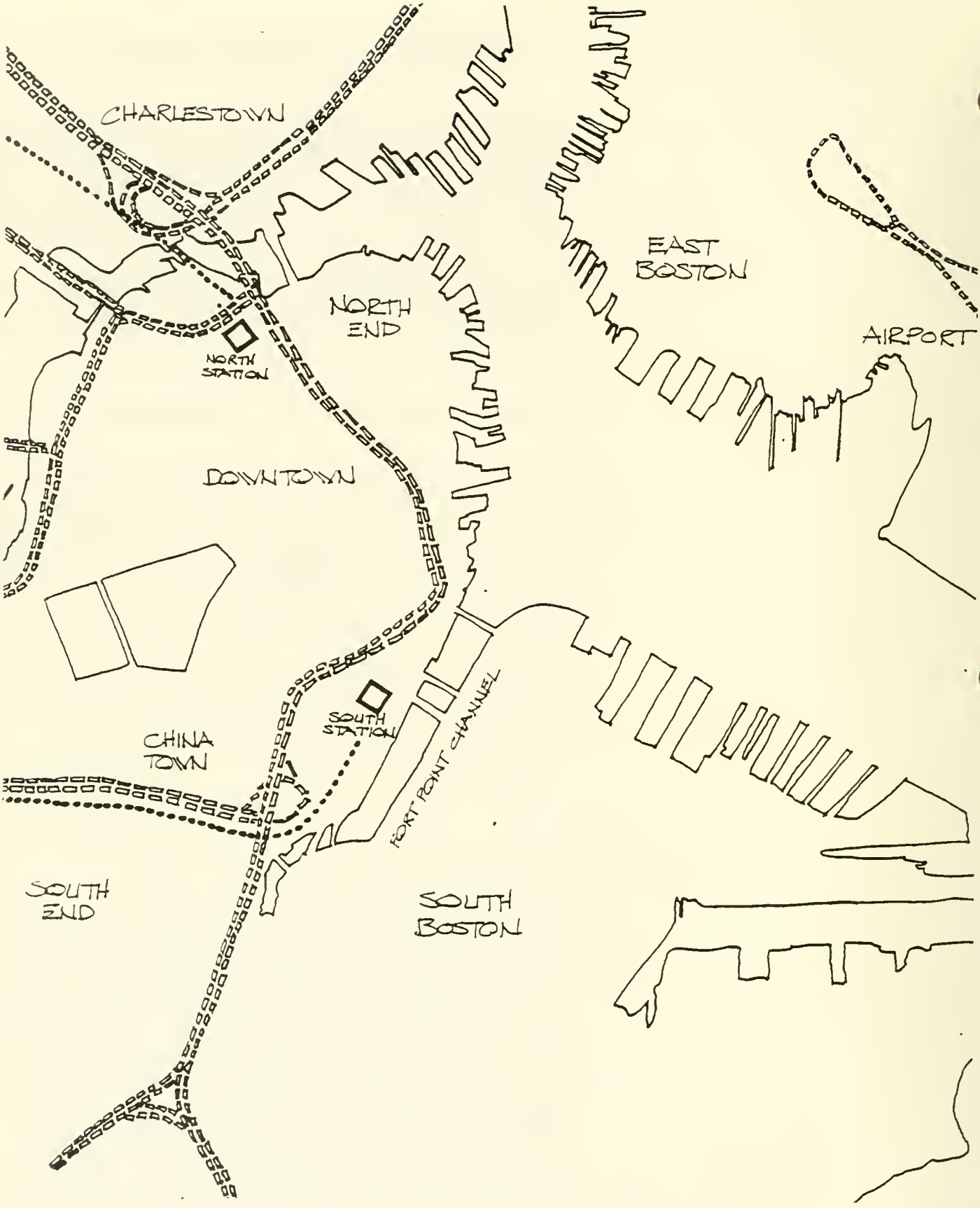
Proposed improvements in the South Area can take place either in conjunction with other improvements or as separate projects. For purposes of analysis, the South Area has been examined as a single project - both no-build and full build - and in conjunction with other related projects. This relationship with other potential projects has produced several permutations of potential improvements which are outlined in Figure 21.

Figure 21: South Area Alternatives

	Without 3rd H.C.	With 3rd Harbor Crossing	
		Special Purpose	General Purpose
NO BUILD	Alt. 1	Alt. 2	Alt. 3
RECONSTRUCTION WITHOUT AREA	Alt. 4	Alt. 5	Alt. 6
RECONSTRUCTION WITH CENTRAL CENTRAL AREA	Alt. 7	Alt. 8	Alt. 9

III.C.3 Feasible Alternatives

Each of the alternatives included in the chart above have been examined in detail to determine system and traffic operations characteristics and the potential impacts which might result from implementation. The alternatives, each of which is discussed below, are followed by a brief discussion of the feasibility of construction of a northbound tunnel within the Fort Point Channel. For Alternatives 4-9, it has been assumed for technical analysis purposes only, that the northbound tunnel in the Fort Point Channel will have three travel lanes with a shoulder, and that modifications will be made to the existing Dewey Square Tunnel in order to meet Interstate Urban Highway standards.



ALTERNATIVE 1: NO BUILD

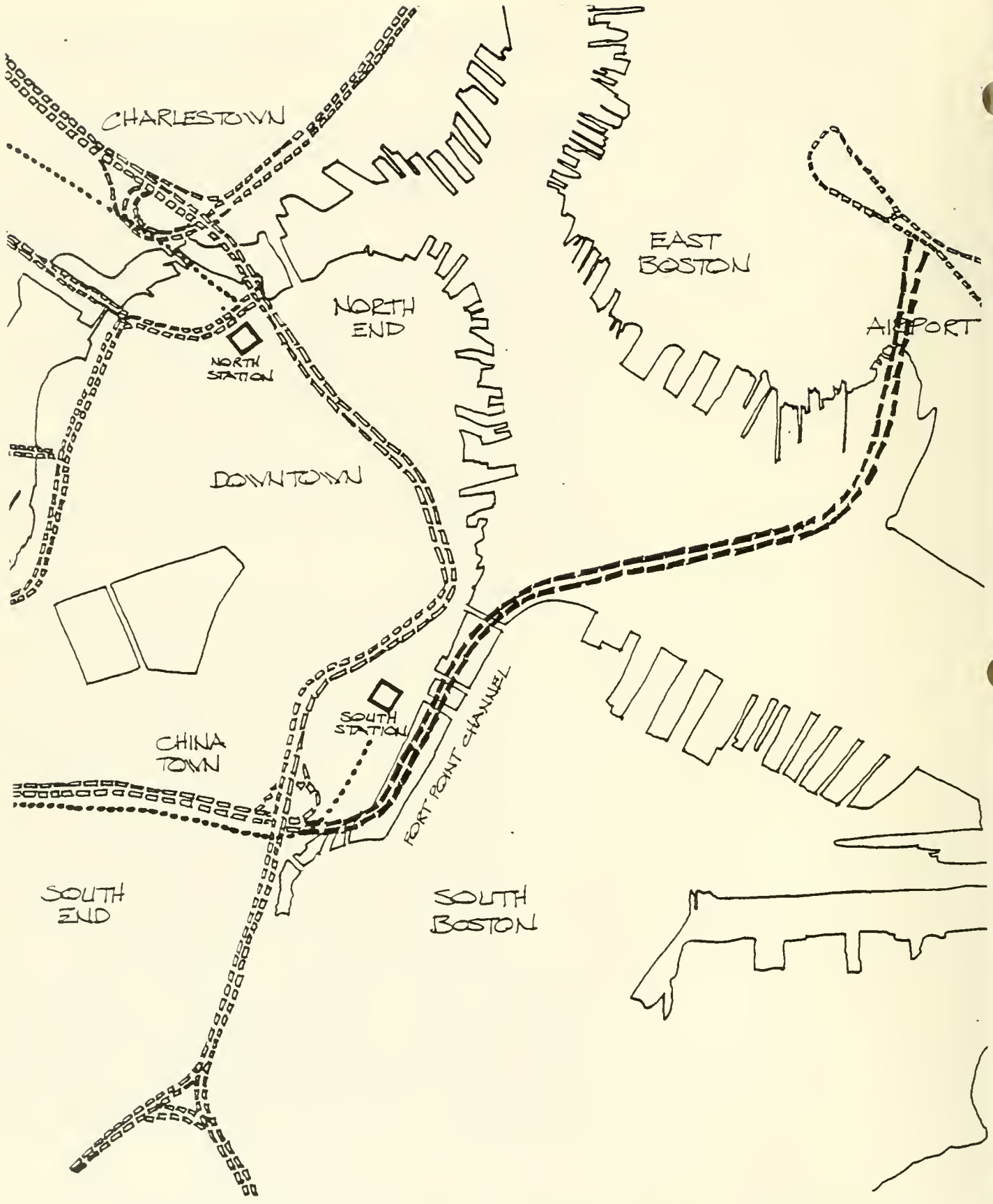
Figure 22

III.C.3.a Alternative 1 - The No Build Alternative

The No Build Alternative has been developed to explore the possibility of retaining the existing facility, with some modifications, in order to maximize its economic life. The viaduct in the South Area needs replacement of the decks within the immediate future if no other improvements are made. Within the past few years the Department has undertaken stop-gap maintenance measures to repair certain sections of these decks. Unlike the Central Section of the Artery, these decks were designed and constructed without protective bituminous concrete wearing surface. As a result, the age of the decks coupled with increasing wheel loads and salting action during the winter months, has contributed to the deteriorating condition of the decks. One possible method of undertaking this work is as follows:

> Rebuilding of one lane of the decks at a time. This method is a standard technique when traffic must be maintained. It has the obvious disadvantage of reducing capacity on a roadway and in this case reducing it by at least one-third. However, during the maintenance operations previously mentioned, some capacity was available on the parallel frontage roads along both sides of the viaduct, i.e., Albany Street on the western side and Frontage Road on the eastern side. If full reconstruction of the viaduct were undertaken, these parallel roadways could be used during the construction period to act as a queue bypass.

Alternative 1 offers no transportation improvements to the South Area. Congestion, delay and accidents can be expected to at least continue at the present level. Contiguous land area will still be subjected to traffic spillover with its associated environmental problems.



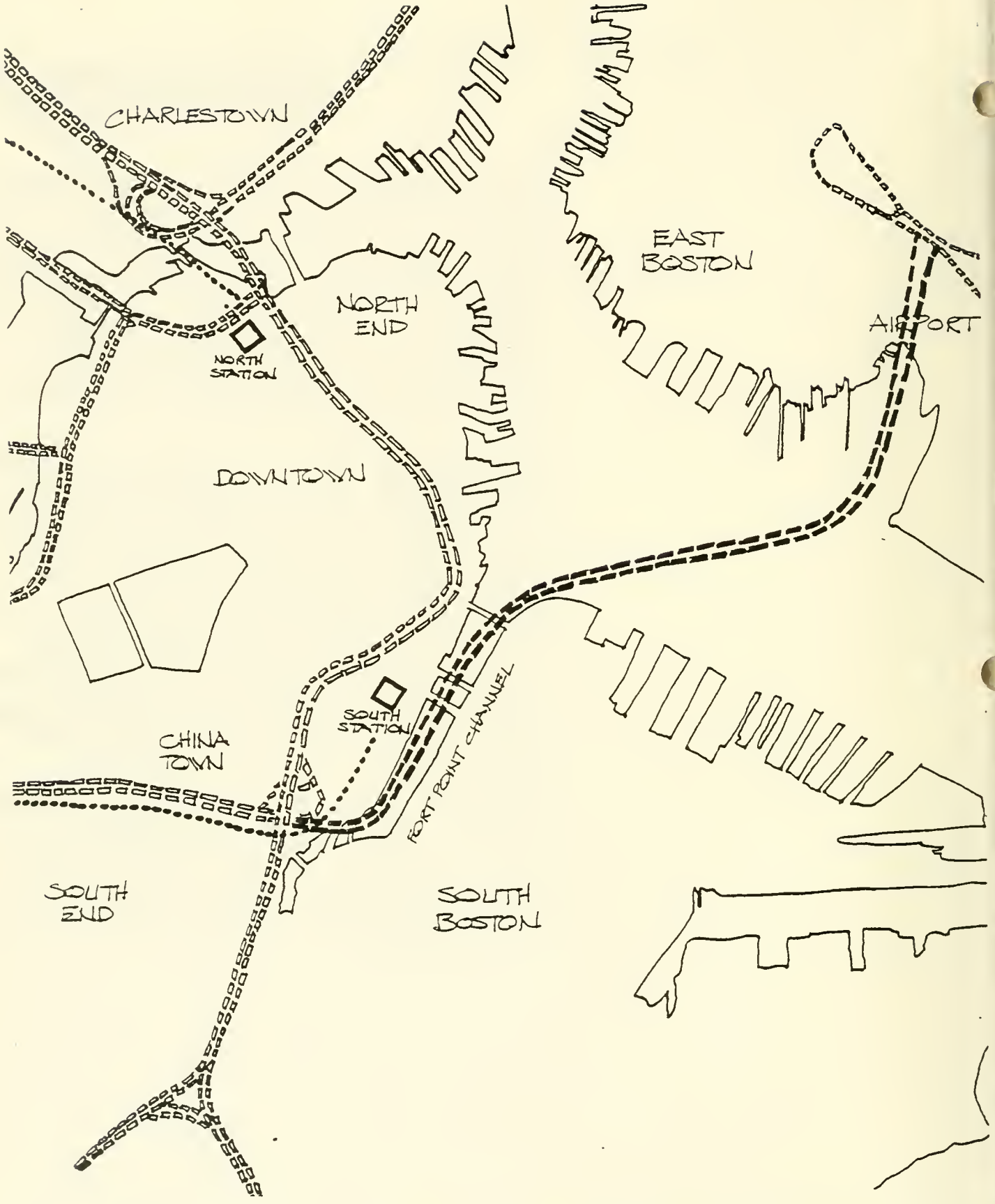
ALTERNATIVE 2: NO BUILD
WITH SPECIAL PURPOSE HARBOR TUNNEL

Figure 23

III.C.3.b Alternative 2 - The No Build Alternative with a Special-Purpose Third Harbor Tunnel

Alternative 2 is similar to Alternative 1 in all respects, except for a Special Purpose Third Harbor Tunnel. The connection between the South Area expressway facilities and the proposed tunnel would be made at the interchange between the Central Artery and the Turnpike. The two-way Special-Purpose Tunnel would be located in the Fort Point Channel. The Dewey Square Tunnel would remain unchanged.

This alternative has no South Area Artery improvements, and would have serious disadvantages for the overall improvement of the Artery and upgrading its safety and efficiency. It would foreclose any major future improvements to the South Area of the Artery and continue the existing substandard operational and safety conditions in the Dewey Square Tunnel. While it would provide improved service to limited types of vehicles, it would primarily serve only those vehicles approaching it from the West and South. From other directions such vehicles would have to travel the full length of the Artery to reach the Tunnel approaches. It would have the salutory effect of removing vehicles from the Central Area of the Corridor, to the extent that the service provided by buses or other multiple-occupancy vehicles could attract more ridership.

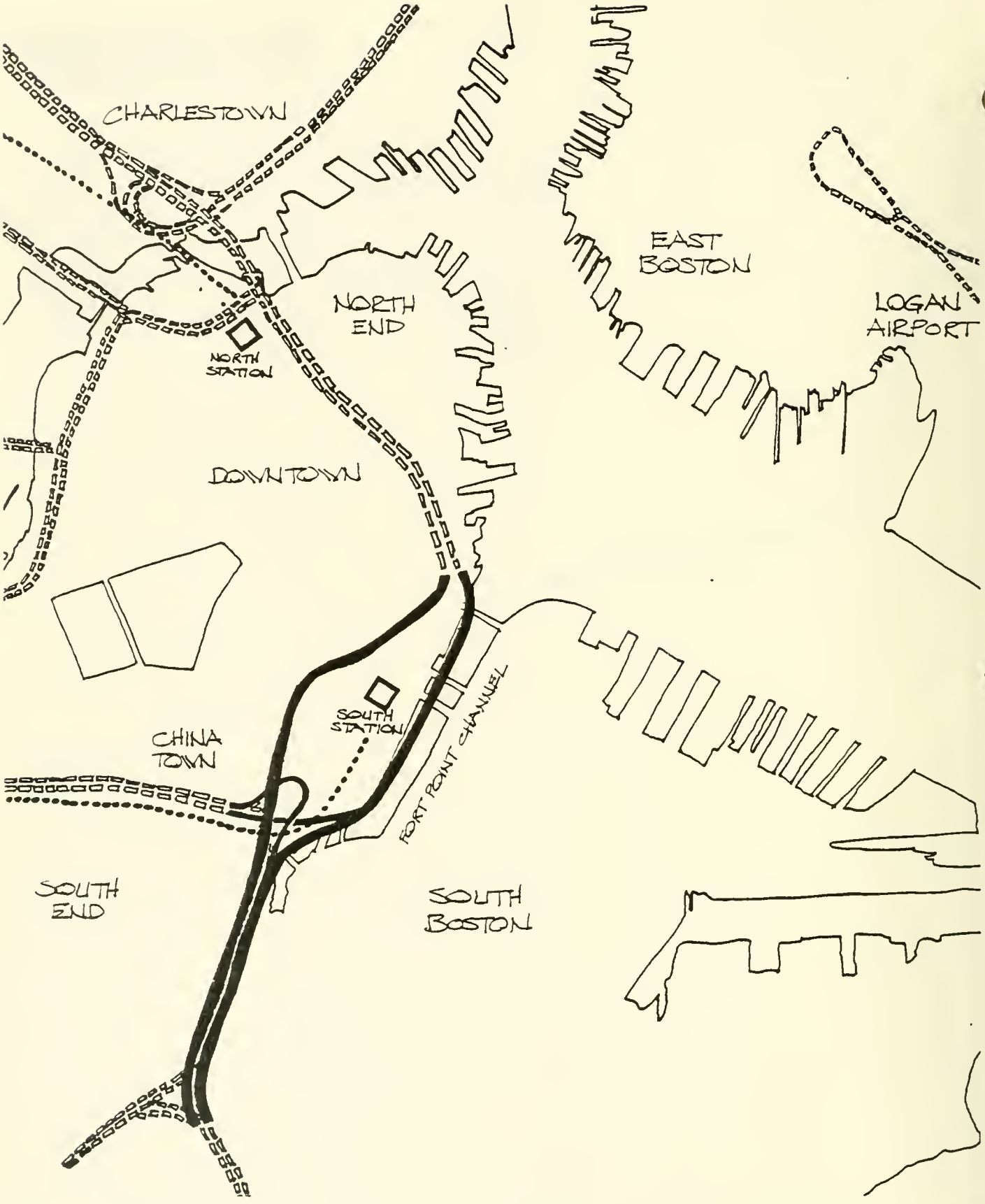


ALTERNATIVE 3: NO BUILD
WITH GENERAL PURPOSE HARBOR TUNNEL

Figure 24

III.C.3.c Alternative 3 - The No Build Alternative with a General-Purpose Third Harbor Tunnel

This alternative is identical to Alternative 2 with the added feature of diverting traffic from the existing Artery. As in Alternative 2, the proposed harbor tunnel would be built in the Fort Point Channel with its interchange at the junction of the Southeast Expressway and the Mass. Pike. There would be no changes in the existing Dewey Square Tunnel.



ALTERNATIVE 4: RECONSTRUCTION
WITH NO OTHER MAJOR IMPROVEMENTS

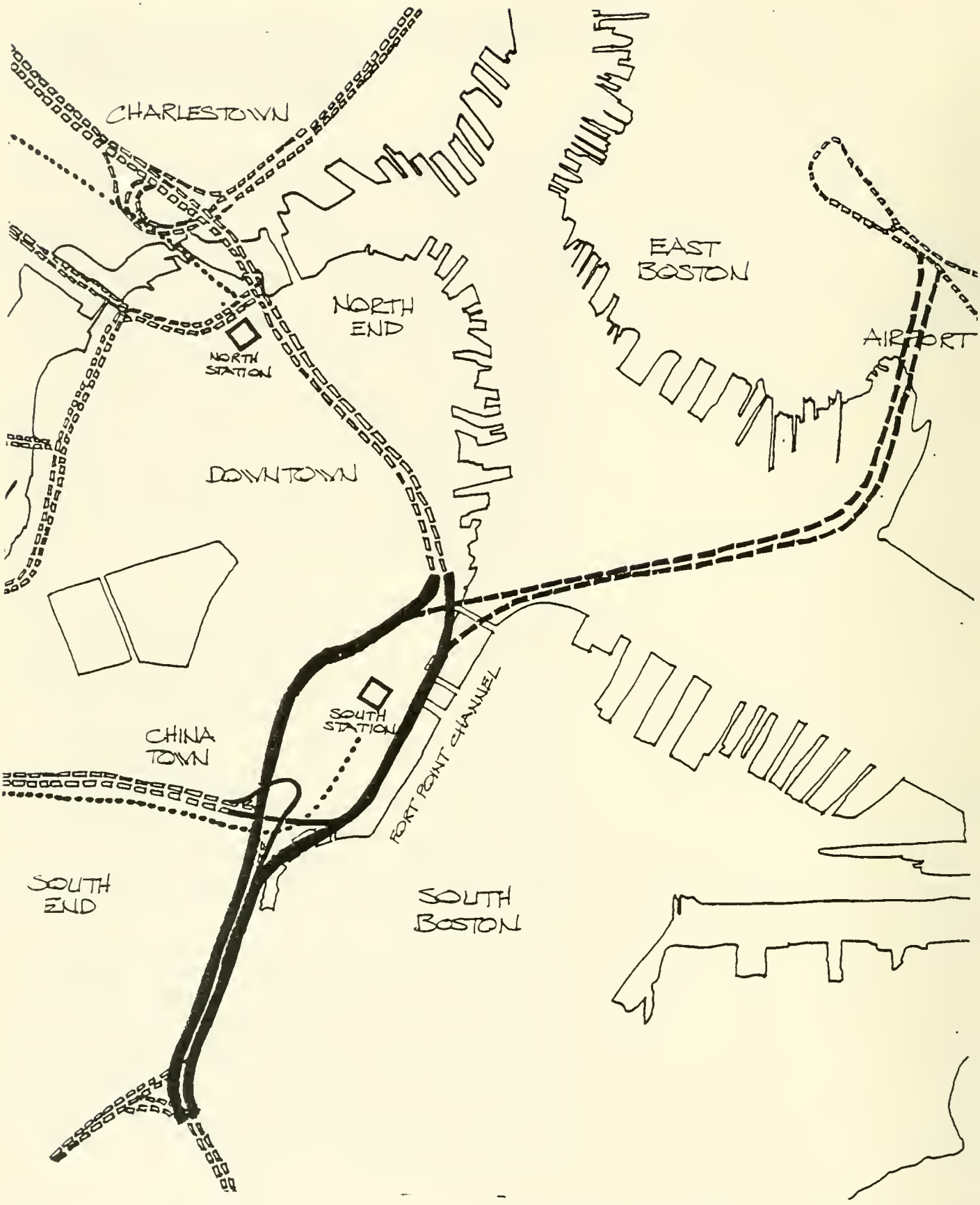
Figure 25

III.C.3.d Alternative 4 - Reconstruction of the South Area of the Artery without the Central Area Project

In this alternative, the South Area of the Artery is reconstructed but no major improvements are made to the Central Section. The reconstruction of the South Area would include the I-93 northbound tunnel located within the Fort Point Channel alignment. It would be connected to the elevated Central Section in the vicinity of Northern Avenue. The Dewey Square Tunnel would be retained for southbound movement. Modification of the tunnel and ramps near South Station would be necessary as well as new ramps to service the South Station Transportation Terminal. Local street connections would be modified to provide improved service between the expressways and the surface street network.

Additional capacity in the Dewey Square Tunnel would provide traffic relief for the South Area. New connections to the local street network would improve access to and from the South Boston Seaport areas, South Station and the proposed transportation terminal, and the retail and financial districts of Downtown Boston. Since these improvements connect directly with the Central Area of the Artery, the Massachusetts Turnpike, and the Southeast Expressway, each of the facilities would also benefit from improved traffic service in the South Area.

Construction of the Fort Point Channel alignment for northbound traffic would proceed as described in Alternative 7. However, this alternative is not contingent upon the Central Area Artery improvements, and thus would require a distinctive treatment of the link between the Fort Point Channel Tunnel and the existing elevated Artery structure near Northern Avenue.



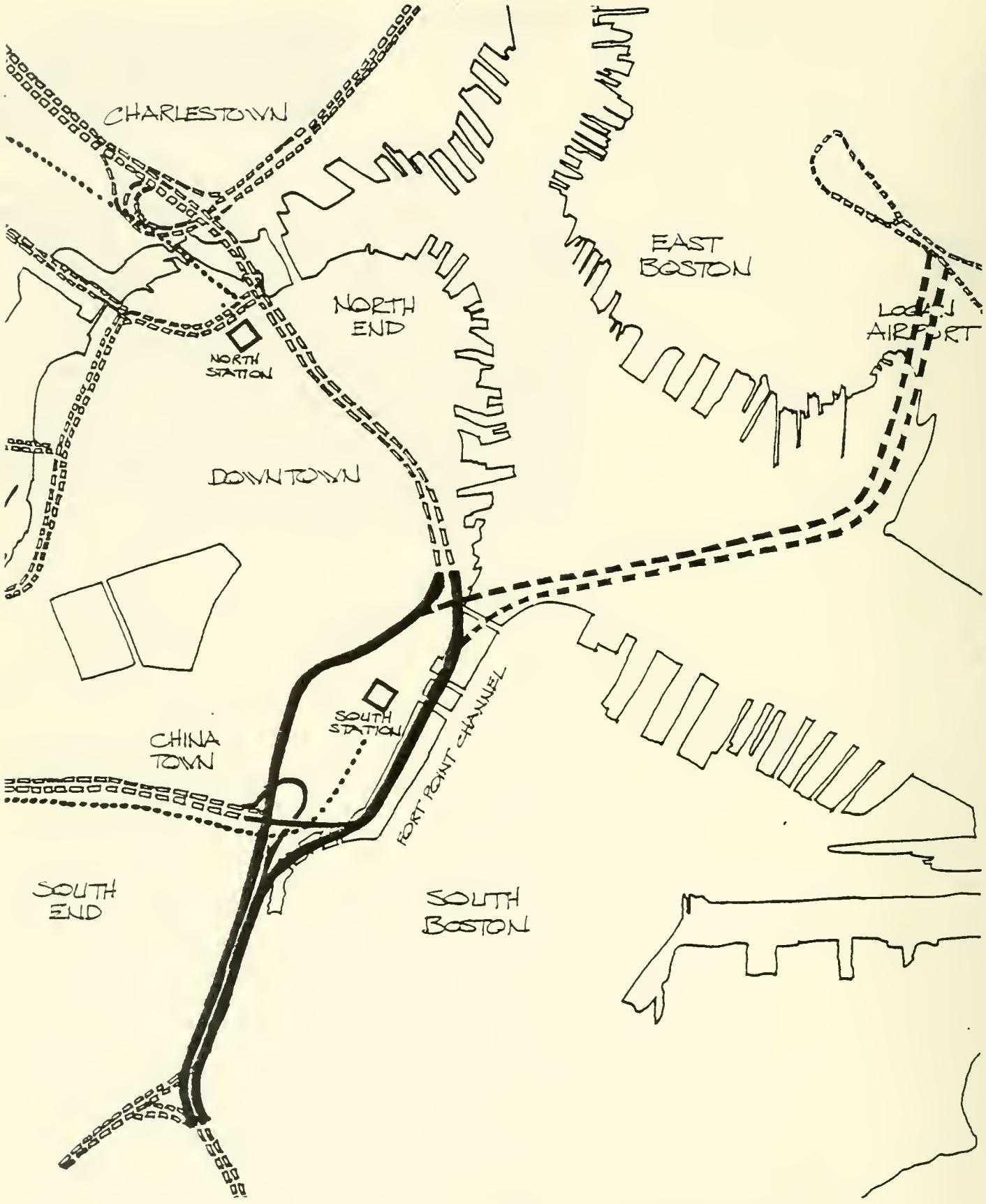
ALTERNATIVE 5: RECONSTRUCTION
WITH SPECIAL PURPOSE HARBOR TUNNEL

Figure 26

III.C.3.e Alternative 5 - Reconstruction of the South Area of the Artery without the Central Area Project and with a Special-Purpose Third Harbor Tunnel

This alternative is similar to Alternative 4 with the addition of the special-purpose tunnel to and from the Airport. Connection to and from the harbor tunnel would be made via the relocated northbound roadway in the Fort Point Channel.

This alternative would allow construction of the northbound roadway and the special-purpose tunnel to be undertaken without disruption to existing traffic. However, connections between the new Fort Point Channel Tunnel and existing roadways could not be made without some traffic disruption during the construction period.

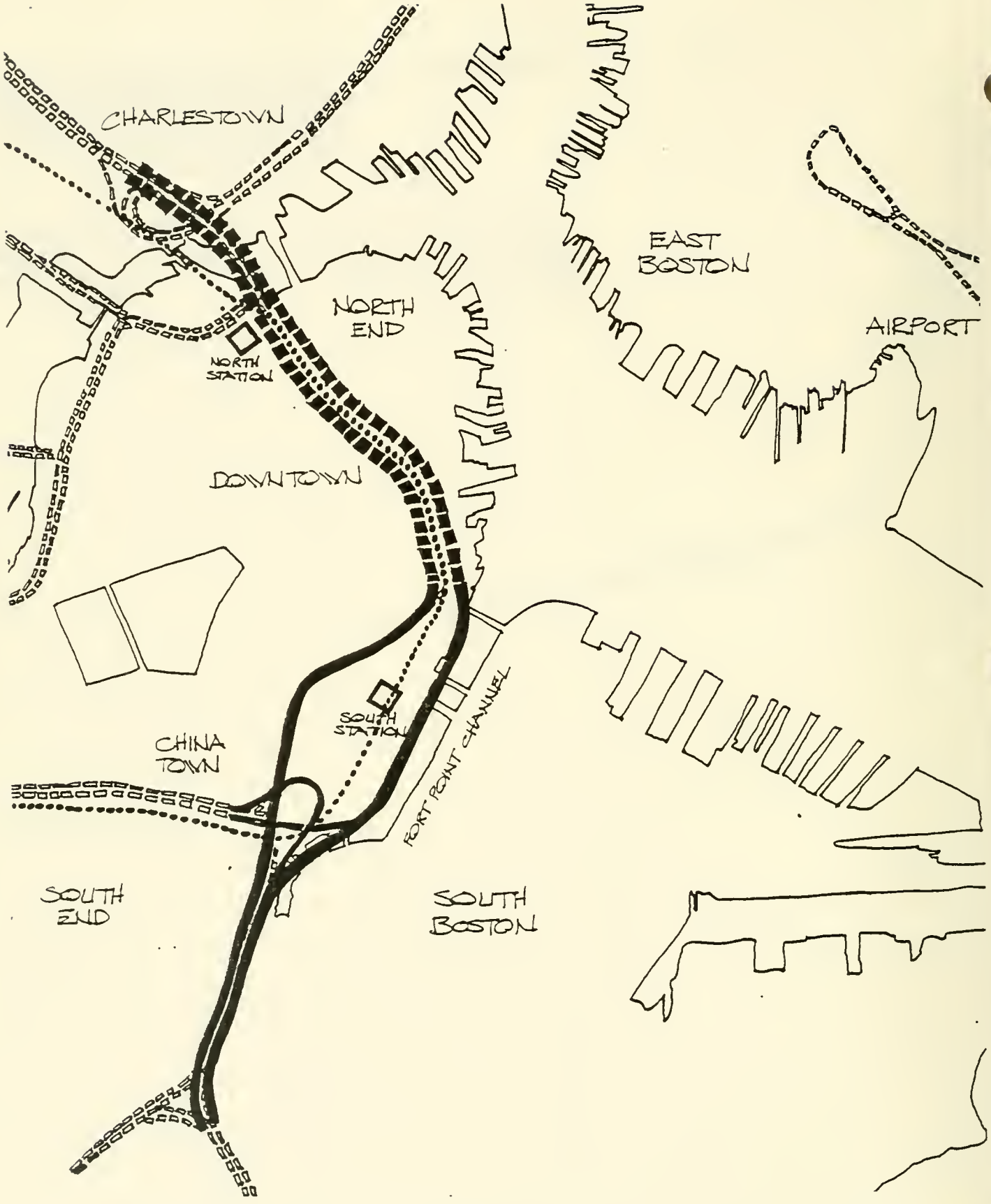


ALTERNATIVE 6: RECONSTRUCTION
WITH GENERAL PURPOSE HARBOR TUNNEL

Figure 27

III.C.3.f Alternative 6 - Reconstruction of the South Area of the Artery without the Central Area Project and with a General-Purpose Third Harbor Tunnel

This alternative is essentially identical to Alternative 5 with the exception of general purpose traffic utilizing the proposed harbor tunnel.



ALTERNATIVE 7: RECONSTRUCTION

WITH CENTRAL AREA RECONSTRUCTION

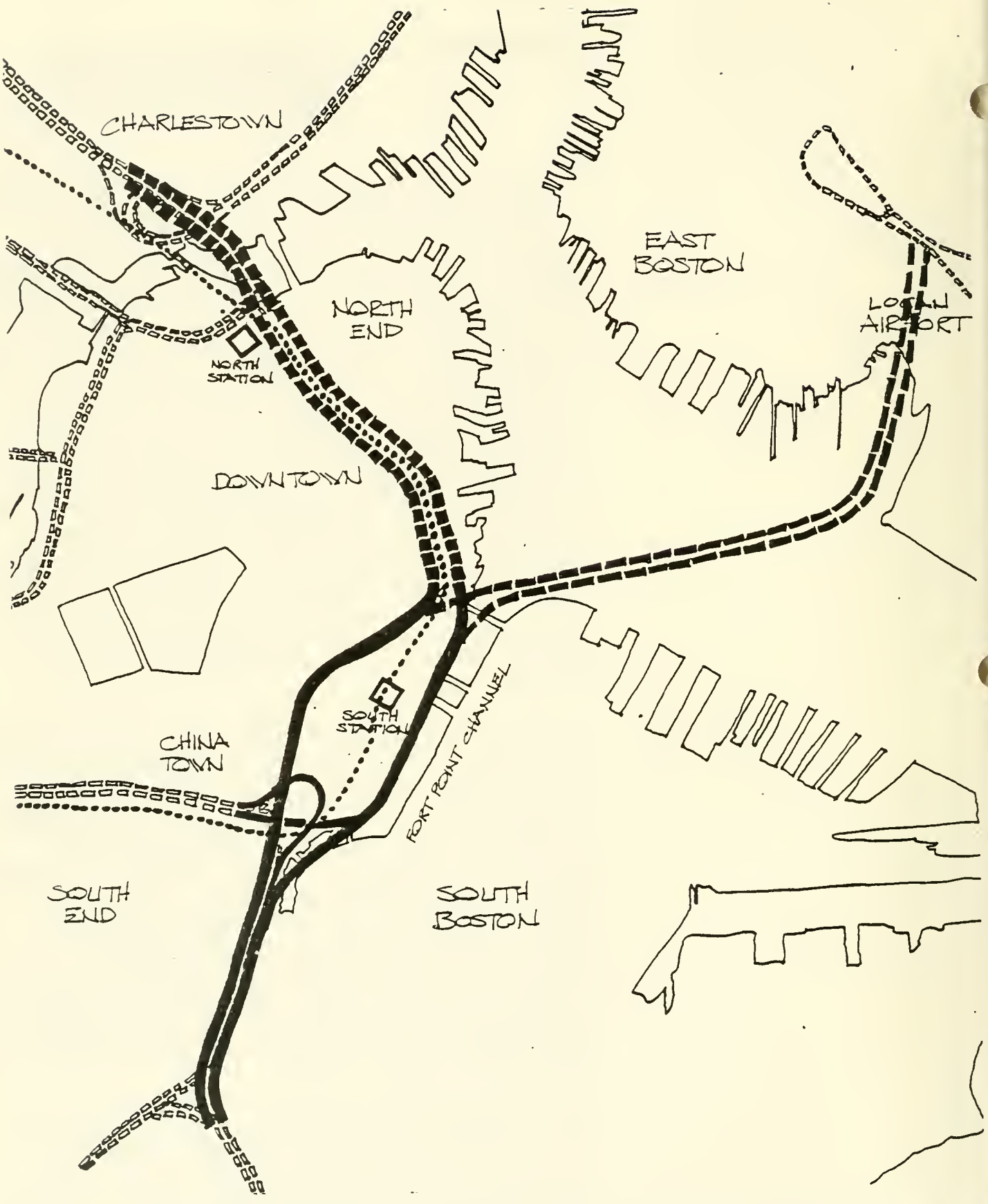
Figure 28

III.C.3.g Alternative 7 - Reconstruction of the South Area of the Artery with the Central Area Project

Alternative 7 provides for a major improvement in the South Area with the construction of a new northbound roadway in the Fort Point Channel. The existing Dewey Square Tunnel would then become one-way southbound. Both the relocated northbound roadway and the improved southbound roadway would link to a rebuilt Central Area of the Artery. The connection, located near the Northern Avenue Bridge, would be underground. Revisions to the existing ramps in the Dewey Square Tunnel would be necessary to provide appropriate connections with local streets. New connections to local streets would be provided from the new northbound tunnel to local streets including Northern Avenue, Kneeland Street/Atlantic Avenue, Broadway, as well as access to and from the proposed transportation terminal at South Station. Additional connections could be provided at a later date to the proposed Third Harbor Tunnel if that facility is to be constructed.

While no definitive construction staging has yet been developed, it is anticipated that the sequencing might proceed by first constructing the northbound roadway tunnel along the Fort Point Channel. Northbound traffic could then be shifted from the existing roadway to the new tunnel alignment. Southbound traffic, north of the Dewey Square Tunnel, could be shifted to the northbound roadway in the tunnel while modifications are made to southbound tunnel tube and connections made to the Central Section. The time frame to complete this work is estimated to be three years, depending on the linkage to the Central Section of the Artery.

The proposed North Station--South Station rail connection, which is part of the Central Area project, is not a part of any alternative for the South Area, except immediately behind South Station. At that location, direct access roads from the South Area into the proposed South Station Transportation Terminal would have to cross the proposed alignment of the underground rail connection.



ALTERNATIVE 8: RECONSTRUCTION

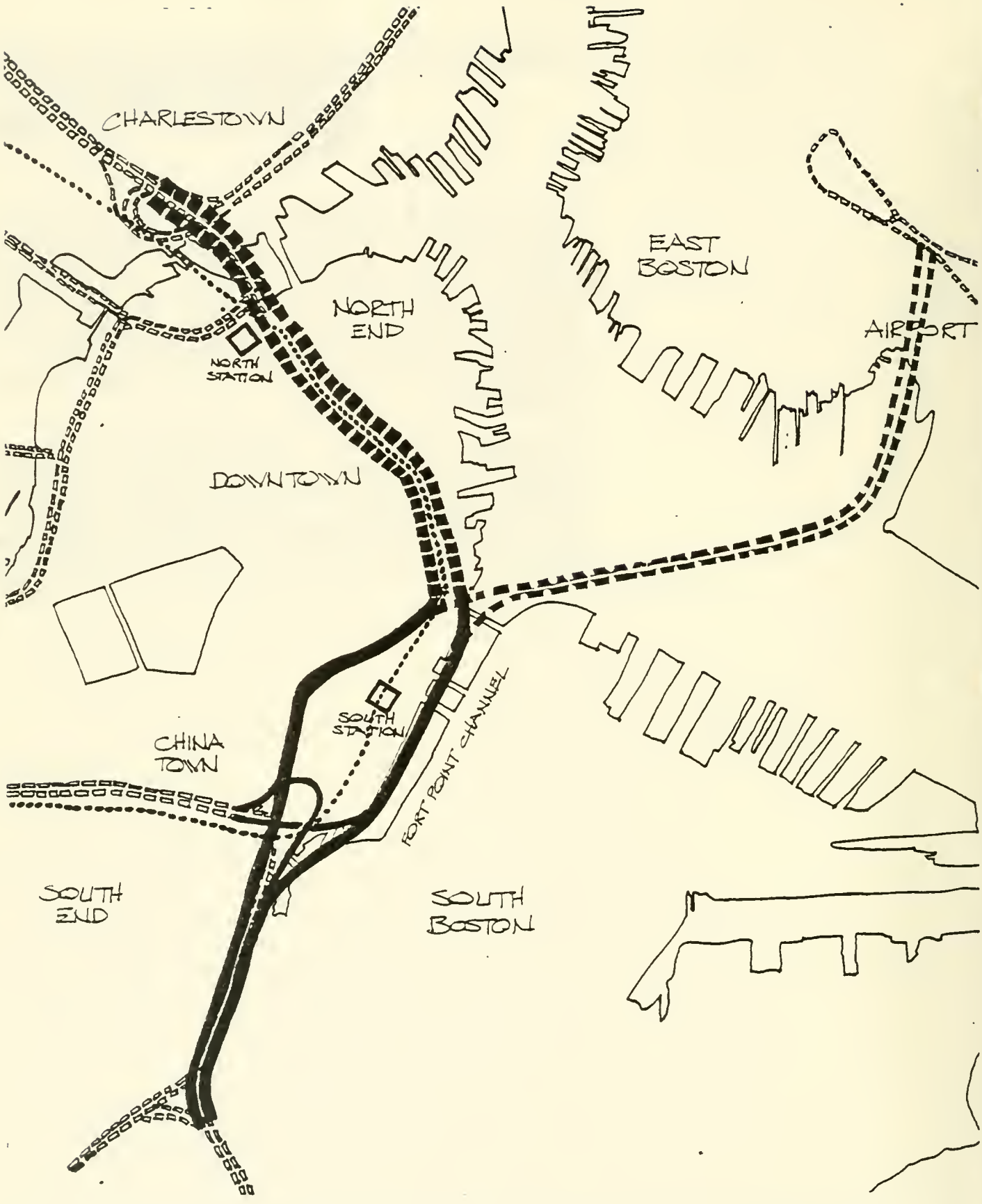
WITH SPECIAL PURPOSE HARBOR TUNNEL AND CENTRAL AREA RECONSTRUCTION

Figure 29

III.C.3.h Alternative 8 - Reconstruction of the South Area of the Artery with the Central Area Project and a Special-Purpose Third Harbor Tunnel

Alternative 8 is similar to Alternative 7 and includes a Special-Purpose Third Harbor Tunnel to and from the Airport. The tunnel would connect with the South Area project at the mouth of the Fort Point Channel, and would link to the new northbound roadway and the existing Dewey Square Tunnel. Local street connections would be provided as in Alternative 7.

As in Alternative 7, construction of the northbound roadway and the special-purpose tunnel could be undertaken without disruption to existing traffic. Construction phasing of this alternative would be closely integrated with the phasing of the Central Area improvements.



ALTERNATIVE 9: RECONSTRUCTION

WITH GENERAL PURPOSE HARBOR TUNNEL AND CENTRAL AREA RECONSTRUCTION

Figure 30

III.C.3.i Alternative 9 - Reconstruction of the South Area of the Artery with the Central Area Project and a General-Purpose Third Harbor Tunnel

Alternative 9 is identical to Alternative 8 except that the Third Harbor Tunnel is a general-purpose facility to and from the Airport. The tunnel would connect with the South Project at the mouth of the Fort Point Channel and lead to the Airport access road. Direct connections between the Third Harbor Tunnel and the North Shore would not be provided in this option. There would be direct connections for traffic between the Southeast Expressway and the Massachusetts Turnpike and the harbor tunnel. Access from the north and northwest to the harbor tunnel would be less direct; this traffic would continue to use the present harbor tunnels for access to and from the airport.

III.C.4 Construction Feasibility

Preliminary plans for the South Area include several alternatives which have been investigated in some detail to determine their feasibility. Those alternatives which rebuild the existing facilities have ample and substantial precedents for feasibility. Replacing of decks has been undertaken on several roadways in the Commonwealth, thus giving precedent on technique for sequencing of construction and undertaking the demolition of existing decking and replacing it with new surfaces.

Those alternatives which call for a new tunnel in the Fort Port Channel have significant distinctions from previous projects to warrant special mention. The preliminary plans call for a subaquaeous tunnel in the Channel to carry northbound traffic. Major problems confronting construction of this tunnel include the proximity of the South Postal Annex, the Stone and Webster Building, the bulkhead supporting Dorchester Avenue, the Channel bridges at Summer and Congress Streets and at Northern Avenue, and the Red Line MBTA tunnels. The transit tunnels are located in mid-channel and are parallel to the proposed northbound Artery tunnel for approximately 2800 feet before turning to pass inland under Summer Street. The transit tunnels were built over 50 years ago and are very sensitive to any changes in the existing balance of sub-surface pressures. Subsurface conditions in the channel indicate the presence of soft compressible and unstable soils overlying clay and glacial till. The design of the Artery tunnel must safeguard the existing Red Line tunnels against imposition of either vertical or lateral loads, both during and after completion of construction.

Preliminary design alternatives have been developed for the Fort Point Channel tunnel. They include a sunken tube, cut-and-cover and mined tunnel designs. If built within the Channel (as opposed to under the right-of-way of Dorchester Avenue) the most appropriate design may be a sunken tube. However, the problems of constructing the tunnel so close to the Red Line tubes may dictate construction of the tunnel within the confines of a diaphragm sheet pile cofferdam, or

concrete slurry wall consisting of continuous bored, cast-in-place concrete piles.

If construction of sunken tube technique is to be utilized, the tunnel sections are constructed off-site and floated into place as needed. Preparation work for the floor to support the tubes is, however, complicated by the presence of the Red Line tunnels. One method which has been investigated is the preparation of the site for each section of tube by installation of a series of underground pile bents. This work is succeeded by the construction of a cofferdam, which allows dewatering of the site, and construction of concrete pile caps to sustain the tubes. When completed, one end of the cofferdam is removed and the prefabricated tubes are floated into place and installed. The entire cofferdam is then removed and surfaces are then prepared for landscaping or other uses.

Alternatively, it is also feasible to construct the tunnel within the confines of a continuous diaphragm wall to serve as a cofferdam. By making the cofferdam wide enough to accomodate the width of proposed construction, it would provide a construction area within which a concrete structure could be constructed in the dry. When completed, the construction cofferdam wall may be retained to serve as a permanent structural wall. At the location where the tunnel must cross the Red Line tunnel (as it turns to go under Summer Street), prestressed-precast tunnel sections would bridge the area without imposing any load on the Red Line tunnels. The foundation support for this bridge type section could consist of either bearing directly on the granular soils as a spread footing, or of pile or caissons founded in glacial till.

Construction inland from the Fort Point Channel is based on more conventional techniques. Alternatives which include direct connections from the Mass. Turnpike to the Northbound tunnel in the Fort Point Channel will require a driven tunnel to pass under the South Station rail yards and merge with the subaqueous tunnel in the Channel. Alternatives which include a tunnel connection with the Central section of the Artery will be in soft ground, clay or glacial till, but will have to include

consideration of old foundations, piles, and other fill which lies underground. Alternatives which connect the proposed Fort Point Channel tunnel with the existing elevated Artery structure will be part below, part above grade in the vicinity of Northern Avenue. In all cases, construction staging will have to be devised to permit continuous operation of existing rail and road operations in the South Area.

Artificial ventilation of road tunnels is required where the noxious and toxic gases and smoke emitted from the exhausts of vehicles become either a danger or a nuisance. The principal hazard is carbon monoxide, and the principal nuisance is reduced visibility caused by smoke and moisture. The concentration of these and other contaminants will vary with the tunnel cross-section, grade and length; the number, size, speed, load and engine type of the various vehicles using the tunnel; the kind of ventilation provided; the source and quality of the fresh air entering the tunnel either by natural or mechanical means; and altitude and wind conditions. The tunnel designer is limited to control of cross section, grade and ventilation, and these have to be combined to produce acceptable results under the worst conditions.

Design considerations must also be given to the effect of tunnel exhaust on surface conditions above. Contaminants are no more acceptable outside than inside the tunnel, so dispersion of the fumes is essential. Traffic noise, fan noise and air noise must be absorbed or attenuated; and the location and velocity of intake and discharge must be carefully established. The number, location, area, height and appearance of intake and discharge structures must not create audible, visible or smellable nuisances, and can, in the alternatives for the South Area, avoid the taking of private property.

III.D ASSESSMENT OF IMPACTS

This discussion summarizes findings of analyses of nine alternatives for the South Area of the Central Artery Corridor. It is based upon past studies and analyses of current proposals for South Area improvements, the detailing of transportation impacts of the current proposals, and the social, economic and environmental consequence of alternative improvements. The following sections include a summary of findings resulting from the analysis--presented in the form of two charts, with explanations in the text which follows (see Figures 31 and 32). For purposes of analysis, it has been assumed that the Fort Point Channel tunnel in Alternatives 4-9 will consist of three northbound lanes, with a shoulder used in peak periods to accomodate traffic demand.

III.D.1 Transportation Operational Improvements

Length of A.M. Northbound Queue

Alternative 1 - 1.80 miles
Alternative 2 - 1.70 miles
Alternative 3 - 1.50 miles
Alternative 4 - 1.35 miles
Alternative 5 - 1.20 miles
Alternative 6 - 0.50 miles
Alternative 7 - minimal queues
Alternative 8 - minimal queues
Alternative 9 - minimal queues

Annual Delay Reduction (hours in peak periods)

Alternative 1 - None at opening, delay to increase over time as congestion builds
Alternative 2 - 53,600 hours
Alternative 3 - 114,200 hours
Alternative 4 - 408,300 hours
Alternative 5 - 742,300 hours
Alternative 6 - 1,110,900 hours
Alternative 7 - 1,061,400 hours
Alternative 8 - 1,121,300 hours
Alternative 9 - 1,155,500 hours

Average Vehicles Speed in Peak Period

Alternative 1 - 19 mph
Alternative 2 - 20 mph
Alternative 3 - 25 mph
Alternative 4 - 28 mph
Alternative 5 - 30 mph
Alternative 6 - 36 mph
Alternative 7 - 38 mph
Alternative 8 - 36 mph
Alternative 9 - 36 mph

Annual Value of Time Saved in Peak Periods - Auto Drivers and Passengers

Alternative 1 -	None at opening, with travel time penalties over time as congestion increases
Alternative 2 -	$ 140,900
Alternative 3 -	327,000
Alternative 4 -	1,141,400
Alternative 5 -	1,760,900
Alternative 6 -	3,187,900
Alternative 7 -	3,290,900
Alternative 8 -	3,316,000
Alternative 9 -	3,360,400

Annual Value of Time Saved in Peak Periods - Bus Passengers

Alternative 1 -	None at opening, with travel time penalties over time as congestion increases
Alternative 2 -	$ 89,400
Alternative 3 -	164,000
Alternative 4 -	614,200
Alternative 5 -	1,431,000
Alternative 6 -	1,589,100
Alternative 7 -	1,273,000
Alternative 8 -	1,505,600
Alternative 9 -	1,608,400

Annual Value of Time Saved in Peak Periods - Bus Drivers

Alternative 1 -	None at opening, with travel time penalties over time as congestion increases
Alternative 2 -	$ 5,200
Alternative 3 -	9,500
Alternative 4 -	35,700
Alternative 5 -	83,200
Alternative 6 -	92,400
Alternative 7 -	74,000
Alternative 8 -	87,500
Alternative 9 -	93,400

Annual Value of Time Saved in Peak Periods - Commercial Vehicles

Alternative 1 -	None at opening, with travel time penalties over time as congestion increases
Alternative 2 -	$ 6,500
Alternative 3 -	15,200
Alternative 4 -	66,900
Alternative 5 -	31,700
Alternative 6 -	147,900
Alternative 7 -	152,900
Alternative 8 -	153,900
Alternative 9 -	155,900

IMPACTS

ALTERNATIVES	ALTERNATIVE 1: Deck Replacement Only	ALTERNATIVE 2: Deck Replacement with Special Purpose Tunnel	ALTERNATIVE 3: Deck Replacement with General Purpose Tunnel	ALTERNATIVE 4: Reconstruction ohly	ALTERNATIVE 5: Reconstruction with Special Purpose Tunnel	ALTERNATIVE 6: Reconstruction with General Purpose Tunnel	ALTERNATIVE 7: Reconstruction with Central Area reconstruction	ALTERNATIVE 8: Reconstruction with Central Area reconstruction and a Special Purpose Tunnel	ALTERNATIVE 9: Reconstruction with Central Area reconstruction and a General Purpose Tunnel
Length of AM queue northbound (miles)	1.80 miles	1.70 miles	1.50 miles	0.70 miles	0.60 miles	minimal	minimal	minimal	minimal
Annual delay reduction (hrs in peak periods)	none; delay to increase over time	53,600	114,200	408,300	742,300	1,110,900	1,061,400	1,121,300	1,155,500
Average vehicle speeds (in peak periods)	19 mph	20 mph	25 mph	28 mph	30 mph	36 mph	38 mph	36 mph	36 mph
Annual value of time saved - auto driver and passr	none; travel time penalties over time	$140,900	$327,000	$1,141,400	$1,760,900	$3,187,900	$3,290,900	$3,316,000	$3,360,400
Annual value of time saved - bus passenger	none; travel time penalties over time	$ 89,400	$164,000	$ 614,200	$1,431,000	$1,589,100	$1,273,000	$1,505,600	$1,608,400
Annual value of vehicle hours saved - buses	none; travel time penalties over time	$ 5,200	$ 9,500	$ 35,700	$ 83,200	$ 92,400	$ 74,000	$ 87,500	$ 93,400
Annual value of veh. hrs saved - commercial veh.	none; travel time penalties over time	$ 6,500	$ 15,200	$ 66,900	$ 31,700	$ 147,900	$ 152,700	$ 153,900	$ 155,900
Annual operating savings - all vehicles	none;increased costs over time	$ 8,600	$ 24,000	$ 83,500	$ 92,100	$ 107,500	$ 162,400	$ 146,800	$ 152,300
Annual number of accidents	449	427	404	114	104	104	114	104	104
Annual accident reduction - percent	none	-5%	-10%	-75%	-77%	-77%	-75%	-77%	-77%
Annual accident reduction - dollar savings	none	$ 50,800	$101,600	$1,222,000	$1,270,200	$1,270,200	$1,222,000	$1,270,200	$1,270,200
Interstate standards	no	no	no	yes	yes	yes	yes	yes	yes

Figure 31: Summary of Anticipated Transportation Impacts

IMPACTS	ALTERNATIVES	ALTERNATIVE 1: Deck Replacement only	ALTERNATIVE 2: Deck Replacement with Special Purpose Tunnel	ALTERNATIVE 3: Deck Replacement with General Purpose Tunnel	ALTERNATIVE 4: Reconstruction only	ALTERNATIVE 5: Reconstruction with Special Purpose Tunnel	ALTERNATIVE 6: Reconstruction with General Purpose Tunnel	ALTERNATIVE 7: Reconstruction with Central Area reconstruction	ALTERNATIVE 8: Reconstruction with Central Area reconstruction and a Special Purpose Tunnel	ALTERNATIVE 9: Reconstruction with Central Area Reconstruction and a General Purpose Tunnel
Direct tax base impacts		no change	no change	no change	slight positive	slight positive	slight positive	positive	positive	positive
Net new acres for development		none	none	none	1.9 acres	1.9 acres	1.9 acres	5.6 acres	5.6 acres	5.6 acres
Dollar value of land for new development		none	none	none	$2,674,000 to $4,980,000	$2,674,000 to $4,980,000	$2,674,000 to $4,980,000	$7,924,000 to $15,726,000	$7,924,000 to $15,726,000	$7,924,000 to $15,726,000
Impact on community quality and character		no change	no change	no change	slight positive	slight positive	slight positive	slight positive	slight positive	slight positive
Air quality impacts		CO: 4990 HC: 620 NO_x: 760	CO: 4970 HC: 620 NO_x: 780	CO: 5070 HC: 630 NOx: 770	CO: 3720 HC: 540 NOx: 990	CO: 3010 HC: 490 NOx: 1010	CO: 3020 HC: 490 NOx: 1030	CO: 3140 HC: 530 NOx: 1270	CO: 3000 HC: 510 NOx: 1210	CO: 3000 HC: 500 NOx: 1210
Noise impacts		no change	no significant increase or decrease	no significant increase or decrease	no significant increase or decrease	no significant increase or decrease	no significant increase or decrease	slight improvement north of Dewey Sq Tunnel	slight improvement north of Dewey Sq Tunnel	slight improvement north of Dewey Sq Tunnel
Water quality impacts		no change	no change	no change	improvement in Fort Point Channel	improvement in Fort Point Channel	improvement in Fort Point Channel	improvement in Fort Point Channel	improvement in Fort Point Channel	improvement in Fort POint Channel
Overall impact - Dewey Sq.Tunnel area		negative	negative	negative	positive	positive	positive	major positive	major positive	major positive
Overall impact - South of Dewey Sq. Tunnel		negative	negative	negative	positive	positive	positive	positive	positive	positive
Project life		30 yrs-decks	30 yrs-decks	30 yrs-decks	40 yrs-tunnel 30 yrs-decks	40 yrs-tunnel 30 yrs-decks	40 yrs-tunnel 30 yrs-decks	40 yrs-tunnel 30 yrs-decks	40 yrs-tunnel 30 yrs-decks	40 yrs-tunnel 30 yrs-decks
Construction Costs - South Area Artery project (000)		$10,640	$10,640	$10,640	$190,580	$190,580	$190,580	$190,580	$190,580	$190,580
Construction Costs - Related projects (000)		none	$409,940	$634,420	none	$312,760	$390,720	$875,000	$1,187,761	$1,265,720
Construction duration		one year	1 year plus 4 years for tunnel	1 year plus 5 years for tunnel	three years	3 years plus 4 years for tunnel	3 years plus 5 years for tunnel	three years	3 years plus 4 years for tunnel	3 years plus 5 years for tunnel
Types of construction disruption		Moderate during peak hours	Moderate during peak hours	Moderate during peak hours	Moderate to severe	Moderate to severe	Moderate to severe	Moderate to severe	Moderate to severe	Moderate to severe

Figure 32: Summary of Environmental & Community Impacts

Annual Operating Savings in Peak Periods - All Vehicles

Alternative 1 -	None at opening, with travel time penalties over time as congestion increases
Alternative 2 -	$ 8,600
Alternative 3 -	24,000
Alternative 4 -	83,500
Alternative 5 -	92,100
Alternative 6 -	107,500
Alternative 7 -	162,400
Alternative 8 -	146,800
Alternative 9 -	152,300

III.D.2 Safety

Annual Number of Accidents, Percent Reduction, and Dollar Savings

Alternative 1 -	449:	0% reduction
Alternative 2 -	427:	5% reduction, at a value of $50,800.
Alternative 3 -	404:	10% reduction, at a value of $101,600.
Alternative 4 -	114:	75% reduction, at a value of $1,222,000.
Alternative 5 -	104:	77% reduction, at a value of $1,270,200.
Alternative 6 -	104:	77% reduction, at a value of $1,270,200
Alternative 7 -	114:	75% reduction, at a value of $1,222,000.
Alternative 8 -	104:	77% reduction, at a value of $1,270,200.
Alternative 9 -	104:	77% reduction, at a value of $1,270,200.

Interstate Standards

Alternatives 1, 2 and 3 do not meet interstate standards; improvements will not bring the roadway up to standards. Alternatives 4 through 9 will meet interstate standards. Modifications to the substandard curves within the existing Dewey Square Tunnel will be made to increase design speeds to Interstate standards.

III.D.3 Community Impacts

Tax Base and Development Impacts

Alternatives 1, 2 and 3 would have no impacts on the tax base nor would they provide new acreage for development. Alternatives 4, 5 and 6 may have tax base impacts as a result of the potential taking of the Sheraton Building. Tax losses as a result of this potential taking could be off-set, with the possible positive tax base impacts resulting from the development of new buildings on an enlarged parcel adjacent to and

over the right-of-way of the Artery. Alternatives 7, 8 and 9, which connect the tunnel in the Fort Point Channel to the existing elevated Artery in the Central area of the Corridor may have negative tax base impacts in the event that it is necessary to take the Sheraton Building. Improvements to the environment of the Artery may produce second order positive impacts as a result of making the area more attractive for investments in redevelopment and reuse of existing structures.

Impact on Community Quality and Character

This is an overall impact evaluation of factors which are difficult to quantify but which reflect community and environmental concerns. These include visual and aesthetic qualities, pedestrian amenities and the local street pattern and its relation to arterials and the expressway network.

Alternatives 1, 2 and 3	No change in community quality and character over the present situations. The present negative influence of the transportation facilities in the area will continue.
Alternatives 4, 5 and 6	Would have a slight positive effect on community quality, differing from Alternatives 7, 8 and 9 in that South Area construction will have to link back to the existing Central Artery viaduct on an aerial structure. In the vicinity of the new structure, community quality will be negatively impacted.
Alternatives 7, 8 and 9	Would have a positive effect on community quality and character, largely because of removing the impacts of spillover traffic on local streets. These improvements would also enhance the pedestrian environment, especially in the Fort Point Channel, where a pedestrian way can be created along the edge of the water. Local streets will be better able to serve local collection and distribution needs, when the expressway spillover traffic is removed.

Overall Impacts - Dewey Square Tunnel Area

Alternatives 1, 2 and 3 - will have continued major negative traffic and environmental impacts in the South Area. These include continued and growing congestion, associated air and noise impacts from expressway and local street operations, spillover of traffic onto local streets, and continued blighting influence of expressway constraints and operations. Opportunities for community improvements would be constrained as a result of the continued negative impacts of the Dewey Square Tunnel on the area.

Alternatives 4, 5 and 6 - will produce major positive transportation improvements in the South Area. Environmental impacts, in the area of the link between the South Area and the existing Central Artery, will be somewhat greater because of the link to the aerial structure.

Alternatives 7, 8 and 9 - will produce major positive transportation environmental improvements in the South Area. These include reduced congestion and delays for all types of traffic, decreased accidents on expressways and local streets and reduction of environmental impacts associated with transportation operations. Major new opportunities for development, pedestrian-ways, public open space, and other amenities would result from these improvements in the vicinity of Fort Point Channel and Northern Avenue.

Overall Impacts - South of Dewey Square Tunnel

Alternatives 1, 2 and 3, which provide only for rebuilt decks in the area south of Dewey Square will have continued negative traffic and environmental impacts on the area. Alternatives 2 and 3 will add traffic impacts in this area, because of access which is provided to the harbor tunnel alternatives. Without reconstruction or realignment of the facility in this area, community impacts will include spillover of traffic onto local streets which are inadequate to handle the demand, especially in the South End area.

Alternatives 4 through 9 will provide a reconstructed facility which will reduce congestion and delays in this area, and decrease accidents on expressways and local

streets. Environmental impacts in the vicinity will be reduced because of improved transportation operations. Opportunities for new development are minimal, but adjacent communities will have fewer traffic impacts and should become more attractive for existing development.

III.D.4 Environmental Impacts

Air Quality Impacts

The proposed changes to the South Area which potentially affect air quality in the area include:

A. Changes in traffic volumes and speeds using the existing expressway corridor will affect gross emissions areawide under all alternatives.

B. Changes in pollutant dispersion would occur in the northern end of the South Area, near the present Purchase Street ramps, if the Central Section of the Artery is depressed (Alternatives 4, 5 and 6). This would mean the enclosure within a tunnel of the presently open section of the South section, and the channeling of emissions from this section into additional ventilation stacks. These new stacks would become point sources, replacing the existing line source of the open roadway.

C. The creation of a new partial right-of-way in the Fort Point Channel to carry northbound volumes to the Northern Avenue Bridge results in the shifting of the emissions associated with these volumes from the old right-of-way area to the new. Most of this length of roadway would be located in tunnel, so that additional ventilation stacks would be required closer to the Channel.

As a first-cut estimate of air quality impacts of the South Area project, calculations of gross pollutant emissions were carried out for each of the nine project alternatives. All calculations were performed using 1975 A.M. peak traffic volumes. Emissions factors used were 1975 average emissions factors from the EPA Compilation document, Supplement 5; as in the No-Build case (defined above as the

"Existing" air quality situation), these emissions factors were speed-corrected to correspond to predicted speeds on individual links. The resulting emission totals of CO, HC and NO_x associated with all alternatives are presented in Figure 33.

Figure 33

Gross Pollutant Emissions
Central Artery (South) Alternatives

	Pollutant Emissions tons/year		
Alternative	CO	HC	NO_x
1 - No Build	4990	620	760
2 - No Build & SP	4970	620	780
3 - No Build & GP	5070	630	770
4 - South only	3720	540	990
5 - South & SP	3010	490	1010
6 - South & GP	3020	490	1030
7 - Central & South	3140	530	1270
8 - Central & South & SP	3000	510	1210
9 - Central & South & GP	3000	500	1210

SP = special-purpose third harbor crossing
GP = general-purpose third harbor crossing

Variations among the alternatives may occur because of:

- differences in demand associated with capacity differences among the alternatives;
- changes in speeds from link to link according to capacity and demand (emissions of all three pollutants are speed dependent);
- minor differences among alternatives in length of roadway, resulting in changes in overall vehicle-miles of travel even when volumes are constant.

Generally speaking, either of the "Artery Build" alternatives produces smaller quantities of CO and HC emissions than does the "No Build" alternative for the corresponding tunnel option; e.g., Alternatives 4 and 7, which include no additional harbor tunnel, are preferable to Alternative 1 in terms of CO and HC pollutant burden. However, the "No Build" alternatives emerge as more desirable in terms of NO_x emissions when compared

with the corresponding "Artery Build" alternatives (4 - 9).

Finally, any new surface ventilation stacks which are required to accompany roadway construction in tunnels will become "point sources" of automotive pollutants. The design and location of such stacks for the area north of Dewey Square (assuming the Central section is depressed--Alts. 7, 8 and 9) and the Fort Point Channel alignment, as well as the detailed analysis of air quality impacts of additional stacks, are steps to be accomplished at a later stage of planning for this project.

Noise Impacts

Several of the changes associated with the various South Area alternatives have the potential to affect noise levels in adjacent areas. These changes, and their likely effects, are discussed below.

A. The creation of a new alignment for the northbound section in the Fort Point Channel - This relocated section of roadway would be located in tunnel for most of its length, and would not therefore represent a major new noise source in the Fort Point Channel. The only potential areas of concern are the tunnel connections to both the Central section and the southbound roadway of the South section. If the Central section is not depressed, the northbound tunnel will emerge above grade to connect with the elevated Central section traversing an area which is not included in the present right-of-way, and creating increased noise levels for abutters of the upgrade. Likewise in the South, the split of northbound and southbound roadways occurs south of the Dewey Square Tunnel; noise levels generated by at-grade visible sections would be shifted eastward of the existing right-of-way.

   In the case of both connections, the land area affected by noise levels from the relocation is industrial or undeveloped land--the South Bay rail yards, the loading areas of the South Postal Annex, the vacant areas around the Sheraton Building --not noise sensitive land uses.

B. The diversion of the northbound traffic discussed in (A) from the existing alignment - The reduction in total traffic volume traversing the existing corridor is about one-half, resulting in a noise level reduction from this single source of only a few dBA (2 or 3 at most). This reduction applies only to portions of the alignment which are not enclosed in tunnel; sections which are in tunnel do not represent the predominant noise source to abutters in their area, and no reduction in noise levels would be perceived by nearby observers.

C. Changes in traffic volumes generated by different alternatives - The relatively minor increases or decreases in volumes traversing individual links will have little or no effect on areawide noise levels.

D. In addition to the above, many of the existing ramps and frontage roads in the South Area would be redesigned to accomodate the proposed Artery changes. Such design changes would possibly cause some increases or decreases in noise levels for a specific street corner, row of buildings, etc. Such changes would be both minor and extremely localized; they can more properly be addressed at a later stage of the planning process, when specific designs for such connections become available.

One particular area to which attention must be devoted is the Chinatown neighborhood located immediately west of the ramps which connect the Artery with the Mass. Turnpike. Hudson Street in this area is lined with 3- and 4-story buildings located within 50 feet of expressway on-ramps.

The South Area project itself probably will not cause any noticeable increase or decrease in noise levels at this location. However, noise levels here are already so high that the area will be evaluated in terms of possible noise abatement measures, such as shielding or noise barriers, to be implemented as part of the South Area project.

Water Quality Impacts

Alternatives 1, 2 and 3 will provide no change in water quality in the South Area of the Corridor. Alternatives 4 through 9 all require construction of a northbound roadway on the edge of the Fort Point Channel. During construction, depending on the method of construction, differential impacts may result in the waters of the channel. Following construction, all alternatives will likely result in a positive impact on water quality as a consequence of roadway runoff control. The Fort Point Channel improvement not only fits with overall plans to improve the quality of the channel water, but may provide an incentive to advance the plans for water outfall treatment and control through integrated construction of the highway and water pollution control facilities.

III.D.5 Costs, Construction Duration and Disruption

Project Life

All deck replacement work anticipated in the alternatives will have a service life of 30 years. All tunnel construction will have a service life of 40 years.

Construction Costs - South Area

Construction costs for the No-Build alternatives (1, 2 and 3) are $10,640,000 in the South Area. This includes only the costs of concrete deck replacements on the existing Artery facility in the South Area.

Construction costs for alternatives 4 through 9 - Reconstruction of the South Area - are $190,580,000 in the South Area. This includes the construction of a new northbound roadway in the Fort Point Channel, connections into the existing facilities on the extremities of the new tunnel, and improvements to the approaches to the Dewey Square Tunnel from the south.

These costs are only for improvements to the Artery itself in the South Area, and exclude related projects, such as the Third Harbor Tunnel and the Central portion of the Artery.

Construction Costs - Related Projects

Alternative 1 - No related projects
Alternative 2 - Special Purpose Harbor Tunnel from Broadway to E. Boston: $407,940,000
Alternative 3 - General Purpose Harbor Tunnel from Broadway to E. Boston: $634,420,000
Alternative 4 - No related projects
Alternative 5 - Special Purpose Harbor Tunnel: $312,760,000
Alternative 6 - General Purpose Harbor Tunnel: $390,720,000
Alternative 7 - Reconstruction of the Central Area of the Artery: $875,000,000
Alternative 8 - Reconstruction of the Central Area of the Artery: $875,000,000 plus Special Purpose Harbor Tunnel: $312,760,000
Alternative 9 - Reconstruction of the Central Area of the Artery: $875,000,000 plus General Purpose Harbor Tunnel: $390,720,000

Types of Construction Disruption

Alternatives 1, 2 and 3	In order to maintain traffic on the expressways, the decks would be replaced one lane at a time. This will result in moderate traffic disruption for the duration of the construction period.
Alternatives 4, 5 and 6	While the northbound roadway is constructed along the Fort Point Channel, traffic on the Artery will not be affected. However, disruption to local traffic could be severe with streets being closed or detoured during construction. There will be moderate disruption resulting from tying the northern end of the tunnel in the Fort Point Channel into the existing elevated Artery.
Alternatives 7, 8 and 9	Similar construction disruption to alternatives 4, 5 and 6. There will be less disruption in the vicinity of Northern Ave. because the roadway is not tied to the existing elevated Artery.

Alternatives 4 through 9	Minimal construction disruption will result from deck replacements on the approaches to the Dewey Square Tunnel. In this area, where the roadway will be modified to link into the new Fort Point Channel tunnel, construction can be phased to allow for shifting of traffic between lanes to minimize the impacts of taking one lane out of service for deck repairs.

Improvements to portions of the South Area of the Central Artery will have to be undertaken within the near future. These improvements are principally deck replacements on the expressway in the area of the corridor south of the Dewey Square Tunnel. These decks are deteriorating and will need replacement if no other work is undertaken in the corridor. However, there are substantial problems in the operations of the present facility which should be examined to determine the appropriate course of action.

Operational problems of the present facility in the South Area must be solved within the present corridor. There are no feasible alternatives to the present corridor in which a new or bypass facility can be located. Alternatives to the present corridor have been examined for all alignments which have been discussed in past or present contexts; none of the alternative corridors provides a feasible location for a new facility.

Within the present corridor, there are few alternatives which improve operations of the South Area of the Artery without extensive negative environmental impacts. Widening the present Dewey Square tunnel, for example, is not an acceptable solution from a community or land damage viewpoint. Double-decking the Tunnel is likewise infeasible. Existing land uses and proposed new developments constrain alternative locations for improvements. Two basic alternatives have emerged: the no build which provides for upgrading the present facility; and a reconstruction which includes a new facility in the Fort Point Channel to provide for northbound movement, with a modified Dewey Square Tunnel providing for south-bound movement. These two basic alternatives have been examined in detail particularly with respect to their relationship to projects external to the South Area; i.e., the proposed improvements to the Central Area of the Artery Corridor, and a proposed Third Harbor Tunnel, for

either general or special purpose use. This analysis led to the examination of nine possible alternatives.

Feasible Alternatives for South Area

The chart below shows the alternative permutations which are possible in the South Area of the Artery Corridor. Alternative 1 is the basic no-build Alternative with Alternatives 2 and 3 as permutations. Alternative 4 is the basic reconstruction alternative with alternatives 5,6,7,8 and 9 as permutations.

Figure 34: South Area Alternatives

	Without 3rd H.C.	With 3rd Harbor Crossing	
		Special Purpose	General Purpose
NO BUILD	Alt. 1	Alt. 2	Alt. 3
RECONSTRUCTION WITHOUT AREA	Alt. 4	Alt. 5	Alt. 6
RECONSTRUCTION WITH CENTRAL CENTRAL AREA	Alt. 7	Alt. 8	Alt. 9

The No-Build Alternatives

Alternative 1, with deck replacement as its major feature, has two variations- Alternatives 2 and 3 - which include deck replacement in combination with previously developed alignments for a third harbor tunnel project. Alternatives 2 and 3 were examined because: 1. previous alternatives for a third harbor tunnel required study in relation to more current thinking about improvements in the South Area; 2. these alternatives are useful analytically for comparing no-build with build alternatives, each of which has been analyzed in relation to the possibility of a separate third harbor crossing project. Previous studies of a third harbor tunnel identified the Fort Point Channel as the most feasible location

for such a facility. However, use of the Channel for a third harbor tunnel, as in Alternatives 2 and 3, would foreclose South Area Artery improvements in that alignment. Current analysis shows that the Fort Point Channel can be used for Artery improvements while at the same time preserving the option for a separate third harbor tunnel at a later date, if that should become desirable. Because Alternatives 2 and 3 foreclose options for South Area Artery improvements, and because they are otherwise identical to Alternative 1, they should be dropped from further consideration as potential solutions for the South Area of the Artery. Alternative 1 should be retained for further study. If at a later date, Alternative 1 is selected, the question of a third harbor tunnel, as raised in Alternatives 2 and 3, can be examined on its own merits as a separate project.

Reconstruction Alternatives

Alternatives 4 through 9 represent the various possibilities of a full reconstruction of the South Area for Artery improvements. Alternative 4 is the basic alternative for reconstruction; Alternatives 5 through 9 are permutations of Alternative 4 which take into account related improvements to the Central Area of the Artery and/or the Third Harbor Tunnel.

Each of the permutations has been included to afford a basis for analysis of the reconstruction as it might relate to subsequent separate projects. Analysis of Alternative 4 has shown that it is possible to construct a new facility which would improve the transportation operations of the South Area without precluding or requiring any subsequent or separate projects in other areas. At the same time, Alternative 4 is compatible with concurrent or subsequent development of the related projects. Because of the potential interactions between South Area Artery improvements and other projects, it is recommended that Alternatives 4 through 9 be carried into further environmental and engineering analysis to determine the effects which might result if other projects are connected to the South Area.

It should be noted that the improvements to the Central Area of the Artery Corridor and the construction of a third harbor tunnel are separate projects, serving purposes and having benefits which are different from the reconstruction of the South Area of the Artery Corridor. The alternatives which have been developed for the South Area, and which should be carried forward (Alternatives 1,4,5,6,7, 8, and 9) have inherent flexibility to accommodate those future projects and the South Area needs, wnile accommodating those potential projects.

Detailed analysis of each of the alternatives is necessary. In particular the following tasks should receive special attention.

a. All alternatives require detailed analysis of:

- construction techniques and phasing
- traffic maintenance during construction
- transportation service
- demand/capacity analyses
- surface street impacts
- relation to harbor crossing demand and airport service
- safety during and after construction
- social impacts (regional and local) during and after construction
- social impacts to adjacent neighborhoods and the region, during and after construction
- land use and urban design considerations
- detailed cost estimates
- employment generation

b. Reconstruction alternatives require, in addition, detailed analyses of:

- ventilation requirements
- joint development opportunities
- decking requirements
- tunnelling requirements
- dangerous cargo handling
- joint rail line construction
- rail line service, space requirements

Anticipated Federal Funding Participation

I-93 is the principal North-South route connecting, in the north, the Boston Metropolitan Area to the Merrimac Valley (Lowell and Lawrence), New Hampshire, Vermont and Canada. To the south, it connects the Metropolitan Area to the southeast area of the Commonwealth, Cape Cod , Rhode Island, and the eastern seaboard. I-90, the Massachusetts Turnpike, a toll facility, connects the Metropolitan Area with the western Massachusetts metropolitan area of Worcester and Springfield, New York State, and states west of New York. Traffic problems associated with the interchange of these two roadways are documented in this report. Volumes of traffic on I-93 approximate 135,000 ADT; on I-90, 60,000 ADT.

Certain alternatives described in this document would require the addition, removal and/or realignment of certain ramp connections between these two major interstate routes. Replacement "in-kind" is anticipated.

Any federal-aided highway is subject to the requirement in Section 301 of Title 23, United States Code, Highways, that it be free from tolls (except for certain toll bridges and tunnels as provided in Section 129). This requirement is met. There is no intention of imposing tolls on I-93, nor are motorists using I-93 required to exit through the I-90 tolls. A large portion of I-93 traffic is not interchanging with the Massachusetts Turnpike. While the I-93/I-90 connection provides a major transfer of traffic between the two interstate facilities, I-93 as part of the interstate system is an essential through route and the major highway in the City of Boston. As long as the present interchange is not improved, motorists on I-93 will continue to experience severe traffic problems from operational and safety viewpoints.

If certain alternatives described were solely improvements for an approach to or from a toll facility, then that particular alternative would not be eligible for federal participation. This is not the case here.

The improvements described in all alternatives are mainly to improve traffic operational conditions on I-93, not I-90. In view of this, it is the opinion of the Department of Public Works that the formula for funding the chosen alternative be on an Interstate 90:10 basis.

APPENDIX I

Previous Studies Related to the South Area of the Artery Corridor

Over the past 15 years there have been many studies of the transportation problems of the South Area of the Artery Corridor. These have resulted in improvements for some situations and a backlog of attempts to correct certain of the Artery problems. The following is a compendium of the studies and subsequent action which has resulted from the studies.

1. Relocated Dorchester Avenue. In 1967, studies were conducted for the MDPW to determine the feasibility of widening the existing Dorchester Avenue. The proposed improvement was for a six-lane roadway in the Fort Point Channel, adjacent to existing Dorchester Avenue. The proposal included filling Fort Point Channel and several alternative construction techniques were examined in order to minimize impacts on the existing Red Line rapid transit tunnels in the middle of the Channel. The proposal required use of the Fort Point Channel alignment, even though special measures would have to be taken to protect the Red Line tunnels. Dorchester Avenue if improved would extend to Northern Avenue from its existing terminus at the bridge over the Channel in South Boston. The present right-of-way of Dorchester Avenue would not be used for new improvements, owing to its sale to the U.S. Post Office Department. After consideration of the proposal and its potential conflicts with proposed land uses along the channel, it was dropped from further consideration.

2. Third Harbor Crossing (Howard Needles, Tammen Bergendorff,1968) This study, directed to be undertaken by the Massachusetts Legislature, recommended a six-lane general-purpose tunnel to

be operated as a toll facility. The alignment chosen was the Fort Point Channel on the Downtown side of the harbor, to East Boston on the railroad alignment through the middle of the community, with connections to C-1 at the entrance to the Airport. The proposal elicited much adverse comment from the community, and led to the need for further examination of the potential alignment and demand for the facility. This work was done in the Boston Transportation Planning Review.

3. Harbor Crossing. The Boston Transportation Planning Review examined proposals for a third Harbor Crossing between E. Boston/Logan Airport and Downtown Boston. General - and special - purpose tunnels were examined on various alignments. Some alternatives included provision for related operations and service improvements, such as satellite parking, rapid transit improvements, bus-limo service, street improvements and high-speed rail in the NE corridor. The basic alternatives were: (1) a six-lane general-purpose tunnel from Downtown to the Airport and north to connect to a new expressway serving the north and north shore; (2) a 2-lane special-purpose tunnel between Downtown and the Airport and no new harbor crossing, but improved rail, bus/limo service and satellite parking; and (3) a no-build alternative, with Central Artery improvements including bus rights-of-way to the Sumner and Callahan tunnels along with major transit and service improvements.

At the conclusion of the study, the then governor recommended the construction of a two-way special-purpose tunnel in an alignment in the Fort Point Channel crossing the harbor and surfacing on airport property to terminate at the airport service road. This tunnel was intended to serve only buses, limos, trucks, emergency vehicles and taxis. It was also intended to be supplemented by major transit improvements and by satellite terminals for park-and-ride between suburbs and airport. After

presentation and deliberation by the state legislature, no approval was granted to proceed with the tunnel.

4. Deck Reconstruction--Southeast Expressway
Reconstruction of deteriorating highway decks on the Southeast Expressway was first suggested in 1973. The original proposals called for replacement of all decks on the Southeast Expressway bridges. Two areas of concern were located within the South Area of the Artery Corridor: approaches to both the Dewey Square Tunnel and the Massachusetts Avenue Interchange, which are on elevated structures. Because of the extent of deterioration, the Massachusetts Avenue Interchange work is now under construction. However, deck replacement at other locations within the South Area has been postponed because of its potential relationship to the Central Artery project in the South Area. Along with the deck reconstruction, other operational efforts are underway to improve capacity and flow on the Southeast Expressway, both during and after construction. These include preferential bus and carpool lanes during rush hours and in peak direction, and the state program to encourage use of transit and carpools.

5. Massachusetts Turnpike Frontage Roads.
The BRA recommended in a 1974 statement of South End transportation issues "a state-sponsored environmental assessment and basic design of alternatives for completing a Turnpike frontage road system from Dorchester Avenue and the Southeast Expressway to Dartmouth Street." This would involve a connection of Broadway with Marginal Road and an extension of Herald Street from Arlington Street to Dartmouth Street, along with related street modifications. The road would serve to remove truck traffic from congested South End residential streets.

6. South Boston Seaport Access Road. In September 1976, the BRA and MassPort selected a consultant to prepare a draft environmental assessment for a seaport access road in South Boston.

Currently, industrial truck traffic randomly utilizes the South Boston local street system in seeking access to the Castle Island container terminal and other industrial or commercial areas located north of West First Street. The Seaport Access road has been proposed to end intrusion of industrial traffic onto residential streets and improve the potential for development of South Boston's 600 acres of underused and vacant land. It would supplement joint private and public efforts to revitalize existing commercial and industrial properties in the area north of First Street and west of Summer Street.

7. New Northern Avenue Bridge Over Fort Point Channel and its Approaches. Plans have been advanced for a new fixed-span Northern Avenue bridge approximately 200 feet southwest of the antiquated existing bridge. An EIS has been completed by the MDPW and final engineering studies await the outcome of final determination of the historic worth of the existing bridge and the issues of navigation of the Fort Point Channel. Northern Avenue and its bridge is the most important and heavily used traffic link betweek South Boston and Boston Proper. The bridge is vital for smooth flow of present and future traffic and for improvement of commercial and residential life in the adjacent and deteriorating areas.

8. Lafayette Place. As part of continuing efforts to strengthen the retail shopping core of Downtown, Lafayette Place has been designed to house new shops, expansion room for a major department store, and parking for shoppers. The major transportation impacts result from the proposed alterations to the Downtown street pattern. Essex Street is proposed to become a major connector into the new development, tying to the Artery Corridor at Atlantic Avenue. The new street would be two-way, and would link to the South Station area near Dewey Square. New parking would be approached from the street, and major connections to the Artery corridor would be essential for ready service to the proposed parking facilities.

9. South Station Transportation Center. The most important new traffic generator in the South Area is the proposed 82-acre South Station Transportation Center, presently owned by the BRA and scheduled to be rebuilt by 1980 as an "intermodal transportation center" serving Amtrak inter-city trains and MBTA commuter and rapid transit trains. Public improvements, totaling over $100 million, will include renovation of the existing "head house," and construction of a passenger facilities center and a rail, bus and auto transportation terminal. An EIS has been completed and reconstruction of the old "head house" has begun. The upper levels of the new Transportation Center will provide up to 2,500 parking spaces and may connect directly to the Southeast Expressway and adjacent streets.

10. Crosstown Street, South End. The BRA is currently designing the portion of the Southwest Corridor Arterial Street that runs from Massachusetts Avenue to Tremont and Columbus Avenues. At Massachusetts Avenue, the street ties directly to ramps of the Central Artery. Construction of the Arterial Street has been declared a non-major action. Actual construction of the arterial will be undertaken by the Massachusetts Department of Public Works.

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